universität wien

DISSERTATION

Titel der Dissertation

"GROWTH, PRODUCTIVITY AND SURVIVAL OF VIETNAMESE ENTERPRISES"

Verfasserin

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Angestrebter akademischer Grad

Doctor of Philosophy (PhD)

Wien, im January 2011

Studienkennzahl lt. Studienblatt:	094 140
Dissertationsgebiet lt. Studienblatt:	Volkswirtschaftslehre (Economics)
Betreuer:	Univ.-Prof. Dr. Burcin Yurtoglu

ACKNOWLEDGEMENTS

I am indebted to a number of people who have supported me during my period of studying and researching.

First of all, I would like to express my special thanks to my first supervisor, Prof. Burcin Yurtoglu in the Corporate Finance Department, WHU Otto Beisheim School of Management for his valuable support, kindness and enthusiasm which have helped me to be able to complete my dissertation timely. I would like to express my great gratitude to Prof. Robert Kunst in the Economic Department, University of Vienna who was always willing to help me whenever I encountered problems. I am profoundly grateful to him for his valuable suggestions and insightful comments, swiftly feedback and encouragement which have helped me a lot in improving the quality of my dissertation. Besides, my knowledge was greatly augmented by Dr. Carlos Carreira in the Economics Department, University of Coimbra, Portugal by his valuable advice and suggestions. I also want to use this opportunity to thank Dr. Pål Sjöberg in University of Gothenburg, Sweden for his precious suggestions and advice which contribute to the content of my dissertation. I also would like to thank Ph.D. Candidate Ben Jann, University of Bern, Switzerland; and senior researcher David Roodman, Center for Global Development, Washington, DC., United State, for their precious supports of econometric commands. I would like to express my sincere thanks to Prof. Amanda Sacker in Institute for Social and Economic Research, University of Essex, UK; Dr. Candidate Trinh Thu Nga and Ma. Gian Thanh Cong in Strategic Analysis and Forecast -Institute of Labor Science and Social Affairs, Vietnam for their valuable supports and precious research documents.

Last but not least, my special love and gratitude go to my beloved parents, my beloved parents in law, my siblings, and the most important persons in my life: my husband, Lai Ngoc Anh and my son, Lai Duc Anh for everything they have reserved for me. Without them and their invaluable supports, it would have been impossible to concentrate on completing the dissertation.

Needless to say, any remaining flaws in the dissertation are entirely my own responsibility.

Nguyen Thi Nguyet.

January, 2011.

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ABBREVIATIONS

ASEAN	Association of South East Asian Nations
CES	Constant elasticity of substitution
CPH	Cox proportional hazard
CPI	Consumer Price Index
GDP	Gross Domestic Products
GSO	General Statistical Office
IDG	International Data Group
ILO	International Labour Office
IS	Information Systems
IT	Information technology
LAN	Local Area Network
MARS	Multivariate adaptive regression splines
MES	Minimum Efficiency Scale
MNCs	Multinational corporations
NIID	Normal, Independent and Identically Distributed
OLS	Ordinary Least Squares
P/Cs	Personal computers
PH	Proportional hazard
R&D	Research and Development
RC	Return to capital
ROC	Return on capital
ROE	Return on equity
SOEs	State-owned Enterprises
TFP	Total factor productivity
VA	Valued added
VND	Vietnam Dong
WTO	World Trade Organization

I. INTRODUCTION

1. Background and relevance of the dissertation

There is an intimate interrelation among firm growth, productivity and survival. Survival is one stage of firm growth; and at this stage, firms have to express the capacity of their personnel and operating efficiencies to attain customers and distribute products[1]. Besides, productivity, a proxy of firm efficiency, is an important determinant of firm survival; the maintenance of high productivity will keep firm survival[2]. Furthermore, firm growth and survival are bound to productivity, that is, firms enter into market and immediately learn about the competitive level of their productivities to grow and survive afterwards (Jovanovic, 1982). In addition, for new firms, the growth goal coincides with firm survival (Coad, 2007). In a nutshell, firm growth, productivity and survival are three important issues of firm dynamic analysis.

Firstly, the analysis of firm growth plays an important role in the field of economic dynamics. From a microeconomic perspective, the more continuously firms grow, the higher probability of survival they have. Growth at a high rate will increase the market share of the firm thus enhancing its competitiveness. From a macroeconomic perspective, economic growth is mainly determined by firm growth (Ghosh, 2008). An increase in firm growth implies an increase in the firm's contribution to gross domestic product (GDP). Firm growth requires a higher demand for production factors through backward linkage, supplies more products through forward linkage, as the results, this boosts economic growth at regional level as well as national level (Ghosh, 2008). Therefore, a dynamic analysis of firm growth in terms of evaluating factors which affect growth becomes extremely important in microeconomics as well as macroeconomics. One law is suggested by Gibrat (1931) that the firm growth rate is random with its size at the beginning of the studied period. There are numerous studies that have tested the validity of this law. However, this law is still disputed due to conflicting findings. The law was supported by some authors (Steindl, 1965; Prais,

[1] Churchill and Lewis (1983) develop 'stages of growth' model, including five stages: existence, survival, success, take-off, and resource maturity.

[2] See Baily et al., 1992; and Doms et al., 1995; Disney et al., 2003; and Esteve-Pe´rez and Man˜ez-Castillejo 2008

1976; and Dunne et al., 1989), but was rejected by others (Reid, 1992; Audretsch et al., 1999; and Calvo, 2006).

While firm size is supposed to have an insignificant effect on firm growth (Gibrat, 1931), productivity is considered an extremely important determinant to increase firm growth (Bottazzi et al., 2006). Productivity represents the *passive learning* effect and improves profitability, as the results, increases firm growth (Ghosal and Nair-Reichert, 2009). In advanced economies, the growth of productivity depends on technological innovation (Brynjolfsson and Hitt, 2003). Information technology (IT) has its greatest impact on productivity (Bresnahan, 1997; Gurbaxani and Whang, 1991; Malone et al., 1989). However, there is a controversy of the relationship between IT and productivity based on the evidence of "the sharp drop in productivity" that "roughly coincided with the rapid increase in the use of IT" in the US, then the "productivity paradox" was introduced[3].

In addition, labour productivity is an important determinant of firm survival; the persistence of high productivity will keep firm survival (Baily et al., 1992; and Doms et al., 1995; Disney et al., 2003; and Esteve-Pe´rez and Man˜ez-Castillejo, 2008). Firms can entry into markets easily, however, most find harsh to survive and this survival difficulty is considered a 'stylised fact' of survival empirical analysis (Geroski, 1995). Besides, new firms have an important role in creating jobs, bringing new products, encouraging technical innovation, and pushing economic growth and competitiveness. Therefore, firm survival determinants are key elements to understand the selection dynamics of market competition (Esteve-Pe´rez, S. and Man˜ez-Castillejo, 2008).

While three above issues are studied mostly in the case of developed countries, few papers have investigated those in developing countries and provided mostly mixed findings. Thus, there are recent calls for further investigations of these issues for developing countries.

Vietnam offers an appropriate laboratory among developing countries to investigate above issues. As a typical developing country in Asia, in 1986, Vietnam conducted a transition from the centrally planned economy, including only state-owned enterprises (SOEs) and co-operatives, to the market-oriented economy, with multi-sectors. One of

[3] Brynjolfsson (1993, pp. 67)

the reasons compelling the government to conduct this economic reform is the inefficiency of its central planned system leading to the failure of many SOEs (Pham and Mohnen, 2005). An economic solution for this issue was promoting private firms and demising inefficient SOEs by the *equitization* of SOEs implemented from 1992. Consequently, over 12 years of *equitization*, the total number of completely equitized SOEs is up to 2,242 with their total capital of around VND 17,700 billion (Loc et al., 2006). In addition, this *equitization* mainly contributed to the transition from SOEs to quasi-private enterprises and medium-sized enterprises (Neupert et al., 2006), which experienced a significantly rapid growth, around 300% during the period 1998 - 2002 (GSO, 2009).

In addition, in recent times, many domestic enterprises have actively accelerated the application of technology, computerize business and production processes, renovate equipment and construction, improve labor skills and qualifications, and even invest in research and development. As the result, the labor productivity growth in Vietnam has been so outstanding as to be higher than all other ASEAN countries during the period 2000-2008[4]. However, labour productivity in absolute terms is still low, even ranking the second lowest among ASEAN countries in 2008, thus, it becomes "one of the biggest challenges in the labour market in Viet Nam,"[5]. Furthermore, new enterprises find it difficult to grow (Tran et al., 2008), and the high failure rate of new private firms indicates their considerable difficulties during market penetration (GSO, 2009).

Besides, the dataset of an annual national census of Vietnamese enterprises with comprehensive information of employees, financial variables, technology and development investments, and multi-cohort size is available for the period 2000-2007. Concisely, Vietnam offers an outstanding opportunity for a dynamic study of firm growth, productivity and survival in developing countries.

Therefore, this dissertation concentrates on the dynamics of firm growth, productivity and survival in developing countries, the case of Vietnam, and investigates their main determinants under the context of globalization during the period 2000-2007. These issues correspond to three essays as follows: i) dynamics of firm growth; ii) technology

[4] Labour and Social Trends in Viet Nam 2009/10, 2010.
[5] http://vietnambusiness.asia/productivity-low-despite-high-gains/

- development investment and firm productivity; iii) survival of new state-owned and private enterprises.

2. Objective, scope and focus of the study

The first essay aims to test the validity of Gibrat's law via the relationship of firm growth and investigate determinants of firm growth in the commercial-service sector in Vietnam for the period 2000-2007. The essay employs a simple dynamic panel model to test the null hypothesis that firm growth is random or 'stochastic' with its size. In addition, a multiple dynamic panel model tests the sensitivity of this "stochastic" relationship to main firm characteristics. Moreover, this essay provides an in-depth analysis of the size effect on growth by using sub-samples according to different cohorts of firm size. Finally, the essay compares its findings with other studies' findings. The essay investigates a comprehensive set of suspected determinants, including capital intensity, financial structure, integration and globalization, especially *passive learning* and employee quality. The aim of this essay is also to extend the literature on firm growth determinants with investigation of a new variable, namely employee quality.

The second essay investigates the impact of IT facilities and development investments on labor productivity to test the "productivity paradox" and determinants of productivity in developing countries, the case of Vietnam. In addition, the study evaluates interaction effects of firm-level contextual factors on the relationship between IT facilities/ development investments and labor productivity. In contrast to most of the existing literature that mainly consider patents or R&D in the relationship with firm productivity[6], the essay investigates actual investments in two main areas: (i) Information technology facilities, including computer[7], internet access, Local Area Network (LAN) connection; (ii) development investments, classified as investment portfolios, including investments for equipment and machinery; construction; and research and development. Moreover, the employed data are multi-sector and multi-size, which will help to close the gap in recent research that most focus on single sector and large firms (Dedrick et al., 2003). Besides, the data cover the years 2001 to 2005, an episode of strong integration and globalization processes in Vietnam.

[6] Ghosa and Nair-Reichert, 2008

[7] 'Computers are best described as a general-purpose technology', Brynjolfsson & Hitt (2003, pp. 793)

The last essay concentrates on the dynamics of new firm development in terms of determinants of firm survival by applying survival model. In details, this essay investigates and compares survival determinants of new SOEs and private firms, which were born in 2000, in a transition economy, Vietnam, during the period 2000-2007. The new firms mentioned here were born in 2000. Since most empirical studies investigate firms in the manufacturing sector, the essay analyses new firms entry in this sector to facilitate comparison. The investigation is emphasized on comprehensive specification of firm-specific, industrial and macroeconomic factors. Moreover, the employed data cover multi-size, which will help to close the gap in recent research that most focus on large firms.

3. Research questions and hypotheses

Essay 1: What is the relationship between firm size and growth of Vietnamese enterprises?

- Hypothesis 1: Firm growth is random or stochastic with its size.
- Hypothesis 2: Firm growth and the relationship between growth and firm size depend significantly on firm attributes.
- Hypothesis 3: These effects change at different size cohorts of firms.

Essay 2: What is impact of the technology - development investments on firm productivity?

- Hypothesis 1: IT facilities and development investments have positive effects on firm productivity.
- Hypothesis 2: Favorable firm attributes and globalization factors improve productivity and the relationship between IT facilities - development investment and productivity.
- Hypothesis 3: The relationship between IT facilities - development investments and productivity is moderated by different economic contexts.
- Hypothesis 4: This relation is inconsistent among different sectors.

Essay 3: What are determinants of new firm survival in a transition economy?

- Hypothesis 1: State ownership benefits firms in terms of survival.
- Hypothesis 2: Firm survival depends positively on sustainability.
- Hypothesis 3: Firm survival depends positively on profitability.
- Hypothesis 4: Smaller firms have higher hazard rate of failure.

- Hypothesis 5: Hazard rate of closure depends on start-up firm factors.
- Hypothesis 6: There are interaction effects among internal and external factors on firm survival.
- Hypothesis 7: Hazard rate of new firm failure depends negatively on competitiveness and concentration of industry.
- Hypothesis 8: Unfavorable current macroeconomic conditions increase the hazard rate of failure.

4. Methodology

Essay 1: Dynamics of firm growth in developing countries

The essay tests Gibrat's law by applying the standard regression model which was initially inspired by Gibrat (1931). In generalizing model, the study follows Goddard et al. (2002a, b) and Evans (1987a) to develop multiple dynamic panel data model of the relationship between the firm growth and size with various firm characteristics. Because Gibrat's law refers to a relationship between firm growth (growth of size) and size, an endogeneity problem may occur. Besides, in dynamic analysis, there is the pervasive existence of unobserved individual heterogeneity[8]. Thus, the problems of unobserved heterogeneity as well as of endogeneity which have been so far neglected in numerous studies will be addressed in this study by applying the GMM system methodology of Blundell and Bond (1998).

Essay 2: Technology - development investments and firm productivity in developing countries

To investigate the relationship between IT facilities/development investments and firm productivity, the essay applies fixed and random effects models with a comprehensive specification of firms' attributes, economic environment and contextual variables. The advantage of this method is allowing to control individual and time effects. Following Brynjolfsson and Hitt (1996), the regressions without *contextual moderators* are firstly estimated to evaluate whether the *direct effects* of IT facilities/development investments on productivity are similar to the prior findings (Dewan et al., 2007; Kothari et al., 2002; Kobelsky et al., 2008). Secondly, following Kobelsky et al. (2008),

[8] Firms have some important but unobserved factors, such as management quality, fame, prestige (Manjo´n-Antolı´n and Arauzo-Carod, 2008).

the model with *contextual moderators* examines whether the relationship between IT facilities/development investments and firm productivity is moderated by firm-level effects.

Essay 3: Survival of new state-owned and private enterprises in a transition economy

The essay employs both nonparametric and parametric methods in survival analysis to understand fully the patterns of firm failure. The semi-parametric Cox proportional hazard model proposed by Cox (1972) is applied due to the advantage of the non-parameterised baseline hazard. That is, it does not require an assumption about the baseline hazard shape over time (Blossfeld & Rohwer, 1995). For the case of discrete time or annual data, Cox and Oakes (1984) showed that there are 'ties' in grouped-form data. To handle these 'ties' failures, similar to most empirical studies, the study applies Efron's (1977) approximation method. To test the proportional hazard assumption, the study applies the Schoenfeld test for each individual factor and for the full set of covariates. The Wald test examines the null hypothesis that all parameters are zero. Moreover, tests for proportional hazard assumption and unobserved heterogeneity which have been so far neglected in numerous studies are addressed in this study. The control of unobserved heterogeneity will avoid biased estimates of coefficients of both explanatory and duration dependence variables (Esteve-Pe´rez, S. and Man˜ez-Castillejo, 2008). CPH model allows this study to examine the effects of various internal and external potential determinants on the hazard rate, with different types of censoring (Juste et al. 2008).

5. Data sources

The primary data employed in this essay are extracted from National census of enterprises in Vietnam during the period 2000-2007, the period of strongest process of integration and globalization in Vietnam as well as the strategic period of national economic development. This census is conducted by Vietnam Government Statistics Organization. It investigates all enterprises, namely State-owned Enterprises, joint stock companies, private enterprises, co-operatives, limited liability companies, partnerships, and foreign invested enterprises in all sectors in the economy. The employed dataset provides comprehensive information of employees, financial variables, and multi-cohort size. The secondary data used in this dissertation are

collected from various sources, such as published and unpublished research reports, working papers, articles and other legal documents.

6. Structure and summary of the dissertation

Essay 1: Dynamics of firm growth in developing countries

The first essay tests the validity of Gibrat's law and investigates determinants of firm growth in Vietnam by employing the dynamic panel model. The aim of this essay is also to extend the literature on firm growth determinants with investigation of a new variable, namely employee quality. The empirical study is set up for both simple and multiple regressions. It is applied for the data of the commercial-service sector and sub-samples of different cohorts of firm size. The balanced panel dataset used in this essay is abstracted from the National census of enterprises of Vietnam during the period 2000-2007. This period corresponds to a strong process of integration and globalization in Vietnam. Applying the system GMM estimator to control unobserved heterogeneity and endogeneity, the findings imply that Gibrat's Law should be rejected. The results confirm the sensitivity of the growth-size relationship to firm attributes. Besides, firm size and labor quality are main determinants of firm growth.

Essay 2: Technology - development investment and firm productivity in developing countries

The second essay empirically investigates the impact of IT facilities and development investments on labor productivity to test the "productivity paradox" and determinants of productivity. In addition, the study evaluates interaction effects of firm-level contextual factors on the relationship between IT facilities/ development investments and labor productivity. In contrast to most of the existing literature that mainly consider patents or R&D in the relationship with firm productivity[9], the essay investigates actual investments in two main areas: (i) Information technology facilities; (ii) development investment capital. The balanced panel dataset corresponds to a strong process of integration and globalization in Vietnam, during the period 2001-2005, and is investigated separately for the manufacturing and commercial-service sectors as well as the whole economy for comparison. Applying the fixed and random effects models, the

[9] Ghosa and Nair-Reichert, 2008

findings imply that the "productivity paradox" does not occur for factor of R&D rate in investments of all firms, for computerization for manufacturing firms, for LAN connection and Internet situation for the commercial firms. And these effects significantly depend on contextual moderating factors.

Essay 3: Survival of new state-owned and private enterprises in a transition economy

The third essay focuses on determinants of survival of new manufacturing state-owned and private firms in a transition economy, Vietnam, during the period 2000-2007. The semi-parametric Cox proportional hazard model is applied with a comprehensive specification of firm-specific, industrial and macroeconomic factors. There is evidence supporting the thesis of a 'liability of adolescence'. Findings imply that the negative effect of state-ownership on firm failure fades out when combined with other effects or economic contexts. After controlling the effect of start-up total assets, private-ownership seems to benefit firm survival. In addition, there is evidence of market selection that labour productivity and profit per employee are the most important internal factors in improving firm survival. There are differences between state-owned and private firms in terms of determinants of survival. Market share and small size are considered obstacles only for SOEs firm survival. However, equitization reduces the risk of SOEs mortality. For private firms, in terms of start-up factors, although total assets increase probability of survival, total sales decrease. Besides, industry which has increasing number of employees opens favourable opportunities only for new private firms. While the macroeconomic factor, GDP, significantly supports the development of private firms, the northern location is an advantage to the survival of SOEs.

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II. DYNAMICS OF FIRM GROWTH IN DEVELOPING COUNTRIES

Abstract

Employing the dynamic panel model, the essay tests the validity of Gibrat's law and investigates determinants of firm growth in developing countries, the case of Vietnam. The aim of this paper is also to extend the literature on firm growth determinants with investigation of a new variable, namely employee quality. The empirical study is set up for both simple and multiple regressions with the data of the commercial-service sector and sub-samples of different cohorts of firm size. The balanced panel dataset used in this paper is abstracted from the National census of enterprises of Vietnam during the period 2000-2007. This period corresponds to a strong process of integration and globalization in Vietnam. Applying the system GMM estimator to control unobserved heterogeneity and endogeneity, the findings imply that Gibrat's Law should be rejected. The results confirm the sensitivity of the growth-size relationship to firm attributes. Besides, firm size and labor quality are main determinants of firm growth.

Keywords: firm growth, determinants of firm growth, developing countries, dynamic panel model, Gibrat's Law, GMM estimator.

1. Introduction

The analysis of firm growth plays an important role in the field of economic dynamics. From a microeconomic perspective, the more continuously firms grow, the higher probability of survival they have (Ghosh, 2008). Furthermore, firms with positive rates of growth will reduce unemployment via creating new jobs, and even push competition in the market. Firm growth at a high rate will increase its market share thus enhancing its competitiveness. Therefore, a dynamic analysis of firm growth in terms of evaluating which factors affect growth becomes extremely important in microeconomics. From a macroeconomic perspective, economic growth is mainly determined by firm growth (Ghosh, 2008). An increase in firm growth implies an increase in the firms' contribution to gross domestic product (GDP). Firm growth requires a higher demand for production factors through backward linkage, supplies more products through forward linkage, as the results, this boosts economic growth at regional level as well as national level (Ghosh, 2008). Therefore, the particularly important question for any economy is which factors firm growth depends on.

One suggestion by Gibrat's law (Gibrat, 1931) is that firm growth rate is random with its size at the beginning of the studied period. ''According to this law, the probability of a given proportionate change in size during a specified period is the same for all firms

in a given industry regardless of their size at the beginning of the period''[10]. Numerous studies have tested the validity of this law. However, this law is still disputed due to conflicting findings. The law was supported by some authors (Steindl, 1965; Prais, 1976, Chap. 2), but rejected by others (Reid, 1992; Audretsch et al., 1999; and Calvo, 2006). Recently, Gibrat's law has been tested in the presence of other potential determinants of firm growth (Higson et al., 2004; Beck et al., 2005; Bartelsman et al., 2005; Fisman and Svensson, 2007).

Whereas most empirical studies testing Gibrat's law focus on developed countries, few studies look at developing countries, including Taiwan (Yang and Huang, 2005), Ethiopia (Bigsten and Gebreeyesus, 2007) and Ghana (Robson and Obeng, 2008). Vietnam offers an appropriate laboratory among developing countries to test the validity of Gibrat's law and investigate determinants of firm growth. As a typical developing country in Asia, Vietnam has implemented an economic transition from the centrally planned economy to the market oriented economy. During this period, Vietnam has experienced tremendous changes in economic structure, which have enhanced the growth of enterprises (Baughn et al., 2004) and international integration, such as joining the WTO in 2006. While Asia has recently become one of the world's three major economic centers, Vietnam has considered one of the most prosperous and successful developing countries in Asia, with the growth rate of real GDP by 7.4% p.a. over the 1990s (Oostendorp et al., 2009), and by 7.6% p.a. during the period 2000-2007 (GSO, 2009). This growth was mainly contributed by the equitization from (SOEs) to quasi-private enterprises and to private small and medium-sized enterprises (SMEs) (Neupert et al., 2006), which experienced a significantly rapid growth, around 300% during the period 1998-2002 (GSO, 2009). Concisely, Vietnam offers an outstanding opportunity for a dynamic study of firm growth in developing countries.

Therefore, this study tests the validity of Gibrat's law via the relationship of firm growth and size and investigates determinants of firm growth in Vietnam. This study focuses on the commercial-service sector due to some following reasons. Most empirical analyses related to this law have focused only on the manufacturing sector (Audretsch et al., 2004; Teruel-Carrizosafa, 2008), not the commercial-service sector although this sector plays no less important role in the economy. Furthermore, the difference of scale economies between the manufacturing and commercial-service

[10]Mansfield, (1962, pp. 1030-1031)

sectors results in their difference of mean efficient sizes (Teruel-Carrizosafa, 2008). All these reasons call for further investigations of the commercial-service sector.

The essay presents some main contributions. The essay employs a simple dynamic panel model to test the null hypothesis that firm growth is random or stochastic with its size. In addition, a multiple dynamic panel model tests the sensitivity of this "stochastic" process to various economic factors. Moreover, this paper provides an in-depth analysis of the size effect on growth by using sub-samples according to different cohorts of firm size. In addition, the essay compares its findings with other studies' findings. Besides, the essay investigates a comprehensive set of suspected determinants, including capital intensity, financial structure, integration and globalization, especially passive learning and employee quality. Particularly, this paper attempts to extend the literature on firm growth determinants with investigation of a new variable, namely employee quality.

In addition, because Gibrat's law refers to a relationship between firm growth (growth of size) and size, an endogeneity problem may occur. Besides, in dynamic analysis, there is the pervasive existence of unobserved individual heterogeneity[11]. Thus, the problems of unobserved heterogeneity as well as of endogeneity which have been so far neglected in numerous studies will be addressed in this study by applying the GMM system methodology of Blundell and Bond (1998). The employed dataset in this study is abstracted from the National census of Vietnamese enterprises for the period 2000-2007. This period corresponds to the strongest process of globalization in Vietnam as well as belongs to ten-year strategy of national economic development.

The rest of the essay is organized as follows. Section 2 is devoted to an overview of the literature and research questions. The next section briefly describes the performance of Vietnamese enterprises. Section 4 focuses on the employed methodology, including model, variables, and data. Section 5 presents the empirical results and analysis. The final section concludes and points out some policy implications.

2. Literature review and research hypotheses

Robert Gibrat (1931) postulated that the growth rate and the size of a given firm were independent. Afterwards, Sutton (1997) developed this law to become the law of

[11] Firms have some important but unobserved factors, such as management quality, fame, prestige (Manjo´n-Antolı´n and Arauzo-Carod, 2008).

proportionate Effect (LPE). Several early literatures supported this law, for instance, Hart and Prais (1956), Hymer and Pashigian (1962), Steindl (1965), Prais (1976), and Dunne et al., 1989. Nevertheless, these empirical tests of the law were not sufficient to support its theoretical point of view due to heterogeneous and sometimes contradictory findings.

The controversial outcome may result from characteristics of firm samples (Oliveira and Fortunato, 2008; Teruel-Carrizosa, 2008). When some further studies investigate smaller and younger firms instead of large and mature firms as in previous studies, the results turn to reject the law. Based on firm samples, Mansfield (1962) classified the literature on this law into three versions. The first version applies the law to all firms, including both survivors and loser. The second type excludes the loser during the analyzed period because they cause sample bias and indicate that the law is valid only for survival firms. This version was underlined by Hart and Prais (1956). The third type argues that the law may be suitable only for firms with output larger than the minimum efficient scale level. This version of Gibrat's law was supported by Simon and Bonini (1958).

Similarly, Geroski (1995) pointed out that the controversial evidence resulted from differences in growth patterns between large and small firms, in this sense, well-established enterprises had growth rates random with their sizes. Afterwards, Sutton (1997) and Caves (1998) developed and defended the hypothesis of ''Gibrat's Legacy'', that is, firm growth rate is random with its size only after it has achieved the minimum efficient scale (MES) of output and become large or mature. In addition, Geroski et al. (2003) argued that Gibrat's law tended to be valid for large-sized enterprises only, or for firms that had exhausted scale economies.

Inspired by Gibrat's law, some scholars have proposed and developed more sophisticated concepts of evolutionary learning, including the *passive* and *active learning* models. The '*passive learning*' model, developed by Jovanovic (1982), indicates that firms' adjustment of size is based on their productivity levels which are realized only post-entry. This model initially explores unknown and time-invariant characteristics which may influence firm decision on its size and growth. It rejects Gibrat's law in the short run with finding that the efficient and smaller firms grow more rapidly than the larger and more experienced ones. The '*active learning*' model, proposed by Ericson and Pakes (1995), argues that firms could invest actively and

continuously to increase their size and productivity. It states "investment, entry and exit decisions depend continuously on the distribution of future states, which in turn depends continuously on those decisions"[12].

In addition, the controversial findings of Gibrat's law may result from different types of economic activity (Oliveira and Fortunato, 2008). For the case of the manufacturing sector, Mansfield (1962) gave evidence to support the law while Utton (1971) did not. Similarly, there was a difference between these sectors in the case of Taiwan (Chen and Lu, 2003). This research gave evidence to reject the law for the manufacturing but not for the service industries. However, Oliveira and Fortunato (2008) suggested that Gibrat's law was rejected for the services enterprises. Besides, Teruel-Carrizosa (2008) found that small firms in the manufacturing industries grew faster than those in the service industries. In contrast, Geroski (1995), and Caves (1998) concluded that there was no difference between the manufacturing and services sectors regarding the validity of Gibrat's law. Some other scholars also distinguished between these industries, however, gained inconsistent findings, such as Kumar (1985), Tschoegl (1996), Almus and Nerlinger (2000), Goddard et al. (2004), and Fotopoulos and Giotopoulos (2008).

Recently, scholars have attempted to investigate under which conditions the relationship between firm growth and size becomes consistent with Gibrat's law. Calvo (2006) investigated whether small, young, and innovating firms gained greater employment growth than others. His results were inconsistent with Gibrat's law and supported the proposition that small firms had grown more rapidly. In addition, he concluded that young firms grew faster than old ones, and innovating activity had a significant positive effect on the firm survival and growth. However, Fotopoulos and Giotopoulos (2008) accepted the law for old, medium, and large firms. Oliveira and Fortunato (2008) employed specifications of financial structure and foreign participation and suggested that Gibrat's law was invalid for the services firms. Lotti et al. (2009) postulated that Gibrat's law was invalid in the short-run, due to the evidence that smaller firms seemed to have higher growth rate. Nevertheless, they detected a considerable convergence toward Gibrat's law in the long run as the evidence of this law. Melhim et al. (2009) found that the smallest and largest firms grew fastest and new entrants grew faster than comparably sized incumbents did. The invalidity of

[12]Ericson and Pakes, 1995, pp. 97.

Gibrat'Law is underlined by Teruel-Carrizosa (2008) with findings that small firms in the manufacturing industry grew faster than those in the service industry. This implies that market structure influences the relationship between firm growth and size.

Furthermore, many subsequent empirical studies provide evidence of the invalidity of Gibrat's law by employing more comprehensive determinants of firm growth (Ghosh, 2009), including age[13], firm ownership structure[14], innovation and technology[15], uncertainty of demand[16], profitability and financial risk[17], human capital[18], capital structure[19], and geographical and macroeconomic factors[20], interaction effects[21]. Moreover, sophisticated econometric techniques are applied (Lotti et al., 2009) to address sample selection[22], endogeneity[23], panel unit root[24], and heteroskedasticity[25].

However, empirical studies of firm growth almost exclusively test Gibrat's law for developed countries. Only few scholars pay attention to developing countries. Yang and Huang, (2005) studied the relationship between the growth rate of firm size and R&D of Taiwanese electronics firms. The results rejected Gibrat's law for small firms but turned out to support the law for large-sized ones, an evidence of the weak form of Gibrat's law, which argues that the law is only valid for firms in a specific size cohort (Simon and Bonini, 1958). Bigsten and Gebreeyesus (2007) focused on the relationship between Ethiopian firm growth and its attributes, and concluded that firm size had a negative effect on its growth.

In general, most studies only focus on developed countries; ignore the effect of lagged growth and issues of both endogeneity and heteroscedasticity (Goddard et al., 2002b). Table II.1[26] summarises some of the most influential studies.

[13] Calvo, 2006; Oliveira and Fortunato, 2008.
[14] Geroski and Gugler, 2004; Oliveira and Fortunato, 2008; Ghosh, 2009.
[15] Almus and Nerlinger, 2000; Calvo, 2006; Ghosh, 2009.
[16] Lensink et al., 2005.
[17] Goddard et al., 2004; Oliveira and Fortunato, 2006; Ghosh, 2009.
[18] Almus, 2002
[19] Adamou and Sasidharan, 2007.
[20] Goddard et al., 2004; Beck et al. 2005; Falk, 2007.
[21] Ghosh, 2009.
[22] Evans 1987a, 1987b; Dunne and Hughes, 1994; Harhoff et al., 1998.
[23] Yang and Huang, 2005; Oliveira and Fortunato, 2008.
[24] Goddard et al., 2002, 2004.
[25] Blonigen and Tomlin, 2001; Teruel-Carrizosa, 2008; Oliveira and Fortunato, 2008; Fotopoulos and Giotopoulos, 2008; Lotti et al., 2009; Ghosh, 2009.
[26] See Goddard et al., (2002b), Audretsch et al., (2004), Lotti et al. (2009) for more literature review.

Table II.1: Empirical Studies of Gibrat's Law

Paper	Sample firms	Size	Obs.	Sample	Model	Sim./ Mul. Dyn. model	Res.	β -1	ρ	Con.
Hart and Prais (1956)	UK, non-financial	Emp.	60	1885–96	(1)*	Sim.	Rej	-0.05		no
		Emp.	250	1896–07	(1)*			-0.09		
		Emp.	571	1907–24	(1)*			0.09		
		Emp.	726	1924–39	(1)*			-0.08		
		Emp.	1,712	1939–50	(1)*			-0.25		
Mansfield (1962)	US, steel,	Cap.	69	1945–54	(1)	Sim.	Acc	0		no
	Petroleum and	Cap.	106	1947–57	(1)			-0.06		
	tyres	Emp.	31	1945–52	(1)			-0.03		
Singh and Whittington (1975)	UK non-financial	Ass.	1,955	1948–60	(1)*	Sim.	Rej	0.06		no
Kumar (1985)	US non-financial	Ass.	1,021	1966–71	(1)*	Sim.	Mix.	-0.04		no
		Ass.	824	1972–76	(3)*			-0.07		
		Ass.	832	1960–71				0	0.1	
		Ass.	694	1966–76				-0.05	0.1	
Evans (1987)	US, manufacturing: 6yrs	Emp.	4,343	1976–82	(2)	Sim./ Mul.	Rej	-0.04		ss., het.
	7–20 yrs		6,124					-0.05		
	21–45 yrs		5,412					-0.02		
	46yrs		1,520					-0.02		
Hart and Oulton (1996)	UK, independent firms	Ass.	55,098	1990–93	(1)*	Sim.	Mix.	-0.17		het.
Harhoff et al. (1998)	Germany , Manufacturing	Emp.	11,000	1989–94	(3)**	Sim.; Mul.	Rej.	-0.1		ss.; het.
Almus and Nerlinger (2000)	W. Germany manufacturing firms	Emp.	39,355	1990–92	(1)*	Sim.	Mix.	0.09		het.
				1991–93				0.07		
				1992–94				0.09		
				1993–95				0.09		
				1994–96				0.08		
Blonigen and Tomlin (2001)	Japanese manufacturing	Emp.	692	1987 -90	(3)**	Sim./ Mul.	Rej.			het.
						Sim./	Rej.	-0.13		
						Mul.	Rej.	-0.08		
Goddard et al. (2002)	Japanese manufacturing firms	Ass.	1,980	1980–96	(3)*	Sim.	Rej	-0.06	-0.1	purt.
Goddard	European	Ass.	583	1992 -98	(5)	Sim.;	Rej			

	banks					Mul.				purt.
et al.						Sim.;	Rej	0.10	0.06	
(2004)						Mul.	Rej	0.09	0.02	
Yang and Huang (2005)	Taiwanese, electronic firms.	Emp.	3,459	1991–98	(2)	Sim.; Mul.	Mix.	-1		het., end.
Calvo (2006)	Spanish firms	Emp.	1,272	1990–00.	(2)	Sim.; Mul.	Rej	0.15		
Fotopoulos	Greek manufacturing	Ass.	3,685	1995–01	(1)	Sim.	Mix			het.
and	All firms						Rej.	-0.03		
Giotopoul							Rej.			
	Micro firms							-0.05		
os (2008)	Small firms						Rej.	-0.02		
	Young firms						Rej.	-0.08		
	Medium, Large, old firms						Acc			
Teruel-	Spanish firms	Emp.	139,922	1994–02.	(2)**	Sim.; Mul.	Rej	-0.26		het.
Carrizosa	Manufacturing							-0.24		
(2008)	Service							-0.28		
Oliveira and Fortunato (2008)	Portuguese service	Emp.	1,923	1995–01	(5)	Sim.; Mul.	Rej	-0.03	-0.4	het., end.
Lotti et al. (2009)	Italian com. equip.	Emp.	3,285	1987–94	(2)	Sim.; Mul.	Mix	–0.15		het.
Ghosh (2009)	Indian, state-owned manufacturing	Emp.	100	1987–06	(3)**	Sim.; Mul.	Rej	-0.66		het.

Note: β: Coefficient on size variable in equations in section '4.1. Research model'.
ρ: Coefficient on lagged growth variable in equations in section '4.1. Research model'.
Sim.: Simple; Mul.: Multiple
*: without evaluation of firms' attributes; **: without lagged value of growth
(1), (2), (3), (4): Orders of equations in section '4.1. Research model'.

Size
Ass.: total assets
Emp.: total employment
Cap.: total capital

Res. : results
Rej.: Reject
Acc.: Accept
Mix.: Mixed results

Controls
ss.: corrected for sample selection
het.: corrected for heteroscedasticity
mea.: corrected for measurement error
purt. : panel unit root tests
end.: Endogeneity

Moreover, a common shortcoming of most studies is that they are not often confined to the reform era, thereby considerably delimiting empirical appeal of reform (Ghosh, 2009). Especially, no research has hitherto provided an analysis for the commercial-service sector with comparison at different sizes and comprehensive specifications of factors under a process of a significant restructuring and globalization process, thus the recent study will cover those issues.

In order to fulfill these gaps, the study tests the below hypotheses:

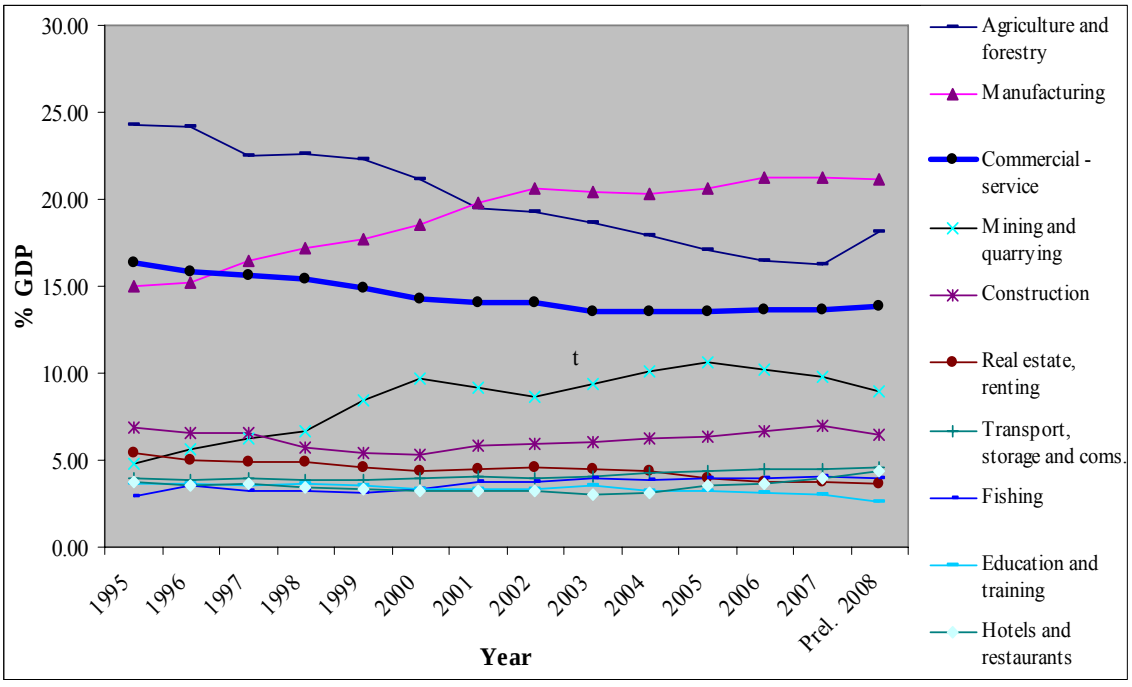
- *Hypothesis 1: Firm growth is random or stochastic with its size.*
- *Hypothesis 2: Firm growth and the relationship between growth and firm size depend significantly on firm attributes.*
- *Hypothesis 3: These effects change at different cohorts of firm size.*

3. Overview on Vietnamese enterprises

This study focuses on the commercial-service sector because this sector plays an important role in contribution of GDP, see

Figure II.1. This sector is categorised in the census as those engage in activities related to trade, repair of automobiles and motors, of personal and household properties.

Figure II.1: Overview of Structure of GDP by Economic Sectors



Source: GSO (2009)

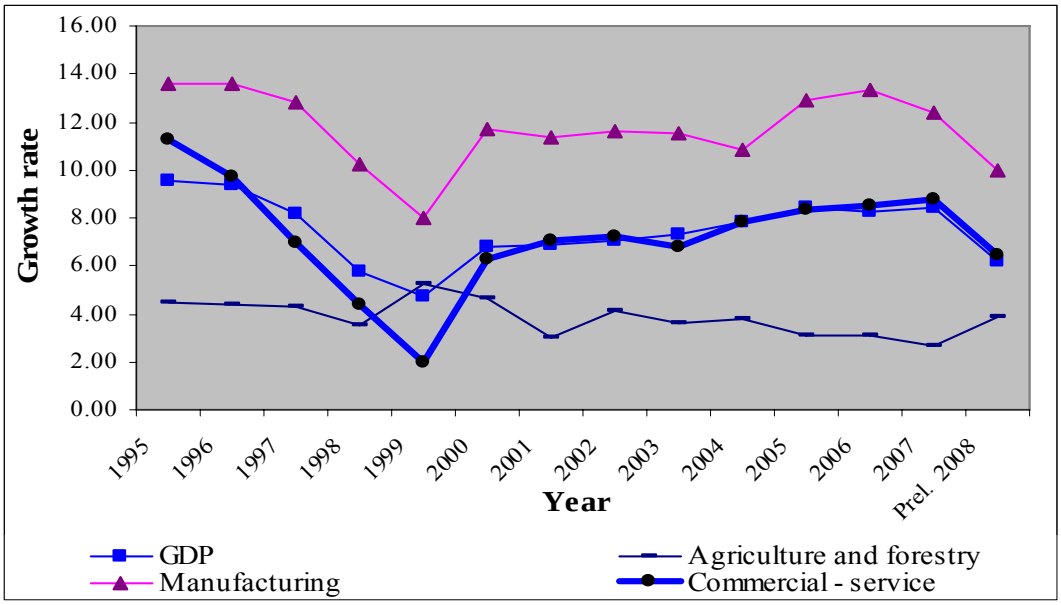
Figure II.1 expresses the top-ten sectors in contribution of GDP among total nineteen sectors in Vietnam. Evidently, from 1997, the commercial-service sector is the third highest GDP-contributing sector. This study focuses on this sector instead of the first ranked sector in GDP contribution, the agriculture and forestry sector, because the economic development strategy in Vietnam encourages firms to move from the agriculture and forestry sector to the commercial-service sector. This study also does not pay attention to the second ranked sector in GDP contribution, the manufacturing and processing sector, because this study intends to fill the lack of study in the

commercial-service sector. There are only slight decreases in the share of GDP of the commercial-service sector during the period 1995-2000. Noticeably, the share of GDP of this sector is steady during 2000s, especially during 2003-2005. However, it turns to slightly increase from 2006. This may be thanks to the fact that Vietnam becomes a member of WTO.

However, there is a fluctuation in the GDP growth rate of the commercial-service sector, see

Figure II.2. Growth rate of this sector decreases noticeably during the period 1995-1999, then increases tremendously from 2000 to 2007. Interestingly, the dynamics of this sector seems to coincide with that of GDP. This suggests that the growth rate of the commercial-service sector may predict that of GDP. In other words, this growth rate may have an important effect on that of GDP. Besides, the growth rate of the manufacturing sector is at the highest and has the same trend as that of the commercial-service sector and GDP. On the contrary, the growth rate of agriculture and forestry sector is at the lowest and experiences a different orientation compared with others in Figure II.2.

Figure II.2: Growth rate of GDP by Type of Economic Activity



Source: GSO (2009)

4. Methodology

4.1. Research model

My starting *hypothesis* is that Gibrat's law (1931) is valid for the case of commercial and service firms in Vietnam. To test Gibrat's law, the standard regression model can be formulated as follows:

$$\ln S_{it} = \alpha_i + \delta_t + \beta \ln S_{it-1} + \mu_{it} \quad \text{(II-1)}$$

where $\mu_{it} = \rho \mu_{it-1} + \varepsilon_{it}$

Following Oliveira and Fortunato (2008), (II-1) can be generalized as follows:

$$Growth_{it} = \ln S_{it} - \ln S_{it-1} = \alpha_i + \delta_t + (\beta - 1) \ln S_{it-1} + \mu_{it} \quad \text{(II-2)}$$

Equation (II-2) is the first order autoregressive model of $\ln S_{it-1}$, the natural logarithm (ln) of the size of firm i at time t-1. This firm growth function considers the simple dynamic panel data model with the null *hypothesis* that firm growth $Growth_{it}$, the first difference of log size, is random with its size, indicating no evidence of a significantly systematic difference in growth between large and small firms. α_i is the unobserved firm specific effects, implying that there is heterogeneity across firms. δ_t represents time effects. β expresses the relationship between firm growth, denoted as $Growth_{it}$, and size. The first hypothesis will become true or Gibrat's law is valid when β is equal to 1. If β is larger than 1, large firms grow faster than small ones. In addition, ρ represents serial correlation in μ_{it}, which is the error term in the growth equation. ε_{it} is a random disturbance and is assumed to be normal, independent and identically distributed (IID) with $E(\varepsilon_{it}) = 0$ and $\text{var}(\varepsilon_{it}) = \sigma_\varepsilon^2 > 0$.

Following Goddard et al. (2002b) and Oliveira and Fortunato (2008), (II-2) can be generalized as follows:

$$Growth_{it} = \alpha_i(1-\rho) + \delta_t + (\beta - 1) \ln S_{it-1} + \rho(\ln S_{it-1} - \ln S_{it-2}) + \eta_{it} \quad \text{(II-3)}$$

where $\eta_{it} = \rho\,(1-\beta)\, lnS_{it-2} + \varepsilon_{it}$ so $\eta_{it} = \varepsilon_{it}$ under $H_0 : \beta = 1$

or

$$Growth_{it} = \alpha_i(1-\rho) + \delta_t + (\beta - 1) lnS_{it-1} + \rho\, Growth_{it-1} + \eta_{it} \quad \text{(II-4)}$$

To investigate the hypothesis of the sensitivity of the relationship between the growth and size to various firm characteristics, this study applies the multiple dynamic panel data model developed by Evans (1987a) as follows:

$$Growth_{it} = \alpha_i(1-\rho)+\delta_t +(\beta-1)\, lnS_{it-1} +\rho Growth_{it-1} + G(X_{it-1}) + \eta_{it} \quad \text{(II-5)}$$

where X_{it} denotes other firm attributes (including labor quality, productivity, total assets, capital intensity, leverage, share of FDI). Variables including labor quality, productivity, total assets, and capital intensity are expressed *in logarithm* form.

Firm growth is expressed by the growth of employment between two consecutive periods. The firm size is measured by the number of employees. The firm size cohorts are categorized based on size distribution of sample. The cohort of micro and small firms is categorized if it is below the 50^{th} percentile, of medium-sized firms is categorized if it is above the 50^{th} percentile and below the 75^{th} percentile, of large firms if it is above the 75^{th} percentile of total employees (size). The models will be estimated separately for whole sample as well as sub-samples according to different cohorts of firm size by the GMM system method.

4.2. Econometric methodology

The GMM-system estimator is developed from the difference GMM estimator, which is firstly presented by Arellano and Bond (1991). In this method, they employs first-difference equations to remove the unobservable firm-specific effects, α_i, and valid instruments from available lagged values of endogenous variables to solve endogeneity. With Monte Carlo tests, Arellano and Bond (1991 indicated that results of this method are more efficient than those of previously used methods. However, it also has shortcomings when the lagged levels of independent variables are not strongly correlated with the subsequent differences, then the instruments become invalid to replace the endogenous variables, leading to the risk of large finite-sample bias (Blundell and Bond, 1998).

Afterwards, Arellano and Bover (1995) adjusted this GMM estimator and then Blundell and Bond (1998) finally improved it, namely GMM system method. In this method, they employed an equation system, including differenced equations and equations in levels, and the unobservable firm-specific effects were removed by orthogonal deviations transformation. With addition of level equation, the variables in levels which are in the second equation will be instrumented by their own first differences, and they

found that this increased efficiency. The analysed instruments are firstly based on assumptions of variable classifications which are predetermined or endogenous, then instrument validity is considered by Arellano-Bond test for autocorrelation, and Hansen test for over-identifying restrictions (Blundell and Bond, 1998).

According to Roodman (2006), GMM system method is designed for the dynamic analysis due to some reasons. Firstly, the GMM system method is suitable for the case of the panel data in this study, that is T (time period, eight years,) <<N (number of observations, 1,613 firms). Besides, this method could be applied for a dynamic process in which the current analysed variable is affected by the lagged ones. In addition, when regressors are not completely exogenous, (such as the lagged dependent variable), the idiosyncratic disturbances, $\mu_{it,}$ might involve in serial correlation and heteroskedasticity. Moreover, when regressors are endogenous; that is, independent variables (such as labor quality) are affected by dependent variables (such as firm growth) then endogeneity problem will occur[27]. Other available methods could not solve all above problems, leading to inconsistent and biased estimators, thus application of the GMM system method is rational (Oliveira and Fortunato, 2008).

4.3. Variables

The firm growth is expressed by the growth of employment between two consecutive periods. The firm size is measured by the number of employees. Number of employees is employed as the proxy for *size* in order to compare with earlier empirical studies. Moreover, this proxy helps to avoid the inflation effects and to find policy implication from the employment perspective. Explanatory variables are theoretically driven, see Table II.2.

Table II.2: Variables

Variable name	Explanations
Dependent variable	
Growth	Annual employment growth is measured by the logarithmic difference of number of employees between two consecutive years: $Growth_{it} = [\ln S_t - \ln S_{t-1}]$
Independent variable	
Size	The firm size is measured by the number of employees of firm.
Labor quality	Total incomes of employees per number of employees.
Labor productivity	Total sales are divided by number of employees.
Total assets	Book values of total assets
Capital intensity	Total fixed capital is divided by number of employees.
Leverage	Book values of total liabilities are divided by total assets
FDI share	Share of foreign direct investment per total registered capital

[27] Roodman, 2006, pp. 15.

Under the process of trade liberalization, Vietnam faces an increasing demand of skilled labor. Thus, to examine the effect of labor quality (*quality)*, the ratio of total earnings of employees per number of employees is used as the proxy for the quality of employees. Labor quality is possibly endogenous if higher firm growth may lead to higher labor quality, in the case that higher growth rates of employment will encourage employees to learn as well as to compete with each other. Besides, Vietnam enterprises do not only need a high quality of employment but they also need an improvement in productivity. Especially, labor productivity represents the passive learning effect as well as the effect of a market selection process (Jovanovic, 1982). Thus, the study employs labor productivity, *productivity,* for these concerns. *Productivity* could be an endogenous variable if firm growth can improve labor quality, thus an improvement of labor quality may enhance productivity. Besides, on one hand, a rational adjustment of the capital–labor structure can improve growth. On the other hand, the extension of business requires an adjustment of capital intensity. Thus, capital intensity could be an endogenous variable in explaining firm growth. In this study, capital intensity (*capitalInten) is measured by* the ratio of total fixed capital to the number of workers. Furthermore, the increasing competition under the process of trade liberalization may cause financial risk thus require firms to adjust their financial structure. Thus, total assets (*asset)* are investigated by using their book value. Similar to capital intensity, the variable *asset* can be endogenous. The financial risk, *leverage,* is defined as the book values of total liabilities divided by total assets. In fact, firm enlargement may require more investment and capital, which could be financed by liabilities. In other words, firm growth may affect leverage then this variable is probably endogenous. In addition, the globalization effect on an economy can be expressed by the amount of foreign direct investment endowed to that economy. Thus, the last explanatory variable is *FDIshare* which is calculated by the share of foreign direct investment per total registered capital of firm. In some cases, firm extension may call for cooperation like foreign participant. Thus, *FDIshare* could be an endogenous variable. When variables are possibly endogenous, the endogeneity problem can occur. All financial variables are deflated by the annual consumer price index (CPI). Variables including *size, quality, productivity, asset, capitalInten* are expressed *in logarithm* form.

4.4. Data

The panel firm-level data employed in this paper are extracted from National census of enterprises in Vietnam during the period 2000-2007. This census is conducted by Vietnam Government Statistics Organization. It investigates all enterprises, namely State-owned Enterprises, joint stock companies, private enterprises, co-operatives, limited liability companies, partnerships, and foreign invested enterprises. In this study, following the category of the census, the commercial and services enterprises are those who engage in activities related to 'trade, repair of automobiles and motors, of personal and household properties'. For the purpose of empirical research, cleaning procedures are followed. Firstly, this study excludes observations with either non-positive or missing values for the employed variables (number of employees, earning, sales, FDI share, total assets, fixed assets, and liabilities). Secondly, outlier values[28] are removed to avoid biased estimates. "An outlying observation, or outlier, is one that appears to deviate markedly from other members of the sample in which it occurs"[29]. Identification of the outliers of the model is based on the standardized residuals and student residuals. Observations with maximum values of the standardized residuals and student residuals equal or greater than 10 and minimum values of those equal or less than -10 are dropped. Thirdly, the dataset is limited to surviving enterprises to analyse the persistence of firm growth during the observed time[30]. Furthermore, the method applied in this study is GMM system, thus estimators are still unbiased with valid instruments. Finally, the used dataset is a balanced panel data with 12,904 observations of 1,613 commercial and service firms with descriptive statistics in Table II.3.

Table II.3: Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max
Growth	-0.004	0.398	-4.567	4.101
Size	80.403	195.309	3	4,964
Labor quality	15.656	15.649	0.054	575.778
Labor productivity (millions VND)	1,413.418	2,890.409	0.147	91,019.350
Total assets (millions VND)	28,485.070	83,075.900	36.910	1,976,993
Capital intensity	50.578	129.305	0.011	2,734.984
Leverage	0.582	0.254	0.000	0.999
FDI share	0.009	0.085	0	1

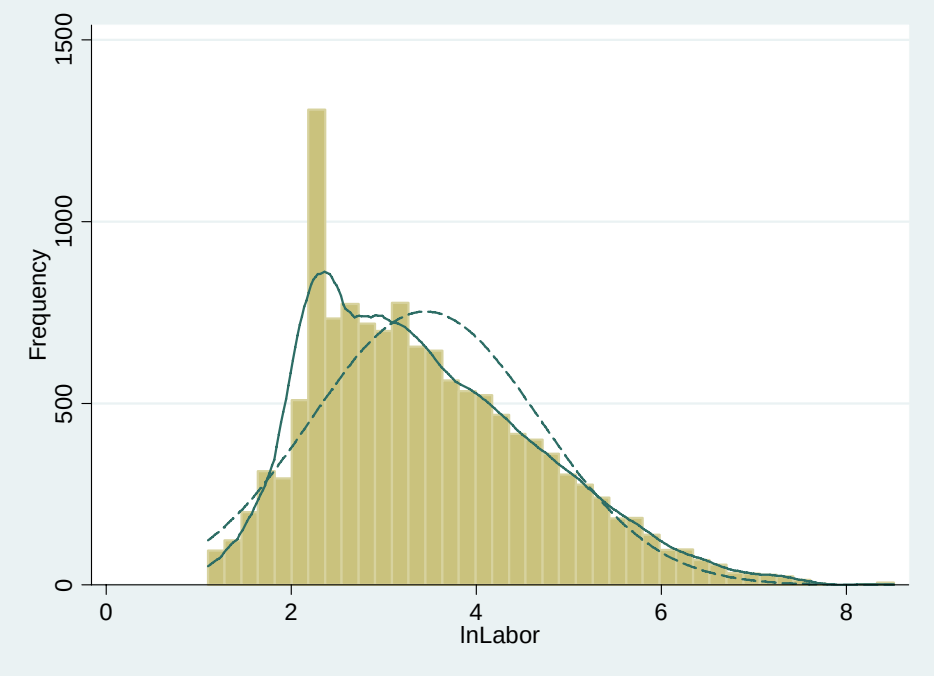
[28] An outlier in a regression relation is a data point with an unusual value, or is an observation associated with large residuals (in absolute terms), a data point that the model fits poorly (Baum, 2006).
[29] Grubbs (1969, pp. 1)
[30] Because of the short interval of growth and short time period of the studied data, the sample selection bias seems insignificant for this case (Oliveira and Fortunato, 2008).

5. Empirical results and analysis

5.1. Log-normality of size distribution

Generally, processes characterized by Gibrat's law converge to a limited distribution, which may be log-normal (Gebreeyesus, 2006). Therefore, the below graph of the distribution of log of employment illustrates whether the size distribution of the commercial and service firms is log-normal as suggested by Gibrat's law. It could be evidence of invalidity of Gibrat's law if this distribution deviates from normal (Gebreeyesus, 2006). In Figure II.3, the dashed line presents normal distribution plot, and the solid line is the kernel density function. The graph shows that the log size distribution is quite far from normal. The highest spike belongs to firms with around ten to thirty employees. The graphical method provides evidence that Gibrat's law is not suitable in this case. However, this method requires more support from empirical results.

Figure II.3: Log-normality of Size Distribution



The next section will analyse the results of the simple and multiple regressions for the commercial and services enterprises in Vietnam[31]. The estimates are displayed from the simple model to the multiple one by adding stepwise variables to evaluate the change of factor effect in various economic contexts. The output is presented separately for the whole sample of commercial-service sector as well as sub-samples of different cohorts

[31] The results estimated by OLS and fixed effect methods shall be provided upon request.

of firm size. In terms of validity of estimators, the study examines the problems of overall model fit by the Wald chi-squared test, the over-identifying restrictions by the Hansen test and the problem of serial correlation by the Arellano-Bond test (m2)[32]. Based on these tests, all reported estimators are adequate and the chosen instruments are valid.

5.2. Determinants of firm growth for the whole samples

In general, the empirical results indicate that the *hypothesis* of the validity of Gibrat's law (1931) is rejected for the case of commercial and service firms in Vietnam. Coefficients on the lagged size variable are all negative and significant (see Table II.4). This provides more evidence similar to other previous studies that small firms grow more rapidly than the large ones. The inclusion of firm attributes in the multiple models reduces the magnitude of the coefficients on the firm size, from -0.5 in model (1) to around -0.2 in models (4)-(7). This suggests that the coefficient of the size variable may be over-estimated in the simple model due to the omission of firm attributes. In other words, the relationship between firm growth and its size depends on the economic context, thus the hypothesis of the sensitivity of the size-growth relation to firm characteristics is supported. In terms of lagged value of firm growth, $Growth_{i(t-1)}$, model (1) suggests that firms that grew fast in the past will grow more slowly in the future or there is no persistent growth for commercial and service firms. With respect to labor quality, the coefficients are all positive and significant. This implies that firms with better qualification of labor will grow faster than others. This represents convincing evidence that the past labor quality acts as a significant stimulus for the current growth. The result is plausible because labor is one of the most important production factors and the creative and learning capabilities of firms depend mainly on the quality of this factor.

With respect to *labor productivity*, the positive and significant results suggest that the passive learning effect enhances firm growth. Similarly, total assets have a positive and significant effect on firm growth. Firms with higher total assets will grow faster than those with lower total assets. In contrast, capital intensity has negative and significant coefficients for all cases. These results indicate that increasing capital intensity is not

[32] The system GMM estimations in this study are computed by Stata software with option of two-step GMM estimator, with option that standard errors are robust asymptotically to heteroskedasticity.

helpful for the commercial-service sector which does not require high level of capital intensity as in the manufacturing sector. An interesting consequence from the results of positive effect of total assets in conjunction with a negative effect of capital intensity (based on fixed assets) on firm growth is that firm growth may be improved by the current assets and short term investments. This is plausible for the case of the commercial-service sector which always needs large amount of current assets and short-term investments for purchasing and selling or service activities.

Table II.4: Determinants of Firm Growth for the Whole Sample

Dep. Var.: Growth$_t$ **Exp. Vars.**	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Growth$_{it-1}$	-0.0555*	-0.0700***	-0.0720***	-0.0632***	-0.0726***	-0.0716***	-0.0745***
	(0.032)	(0.021)	(0.021)	(0.019)	(0.020)	(0.019)	(0.019)
Ln(size) $_{it-1}$	-0.5181*	-0.3425***	-0.1735***	-0.2211***	-0.2112***	-0.2093***	-0.1868***
	(0.295)	(0.109)	(0.046)	(0.044)	(0.044)	(0.045)	(0.045)
Ln(quality) $_{it-1}$		0.0222	0.0535***	0.0557***	0.0604***	0.0623***	0.0635***
		(0.031)	(0.020)	(0.015)	(0.015)	(0.015)	(0.015)
Ln(productivity) $_{it-1}$			0.0417***	0.0294*	0.0356**	0.0406***	0.0468***
			(0.014)	(0.015)	(0.015)	(0.014)	(0.015)
Ln(asset) $_{it-1}$				0.1069***	0.1047***	0.1136***	0.0960***
				(0.027)	(0.030)	(0.037)	(0.037)
Ln(capitalInten) $_{it-1}$					-0.0423**	-0.0426**	-0.0354*
					(0.018)	(0.019)	(0.019)
Leverage $_{it-1}$						-0.1443**	-0.1379**
						(0.067)	(0.069)
FDIshare $_{it-1}$							-0.1803*
							(0.097)
Constant	1.4855	0.7923*	-0.1613	-0.8887***	-0.8370***	-0.8699***	-0.8603***
	(1.062)	(0.455)	(0.237)	(0.167)	(0.156)	(0.175)	(0.177)
Wald chi-squ. test	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hansen test	0.31	0.19	0.19	0.42	0.30	0.24	0.22
Arellano-Bond test AR(2)	0.52	0.40	0.26	0.25	0.28	0.28	0.30
No. of instruments	14.00	22.00	48.00	63.00	68.00	79.00	87.00
Cor. coefficient	0.27	0.32	0.42	0.43	0.43	0.43	0.44

Note: The table provides the results of the two-step system GMM estimator. (*), (**), (***) denote statistical significance at least at the 10%, 5%, and 1% levels, respectively. "Wald chi-squ. test" examines the null hypothesis that all parameters are zero. "Hansen test" is a test of the null hypothesis of the over-identifying restrictions. "A.-B. test AR(2)" is a test of the null hypothesis of no second order serial correlation. For each period, this study treats right-hand variables as endogenous ones in all regressions, with lags from t − 2 in the first-differenced equation and lags from t − 1 in the level equation as instruments. All models are regressed with time dummy variables. This study does not report these variables here. The sample consists of 1613 commercial-service firms and a total of 12,904 observations.

Besides, leverage has a negative impact on firm growth. This may be related to the fact that the risk in finance will be an obstacle for firms to grow. For example, a high demand of financial resource will increase its cost, thus, to access a financial resource, firms may have to exchange a cost which is too high compared with their low revenues. This interpretation differs from the explanation of Oliveira and Fortunato (2006) for the case of Portuguese manufacturing firms. The explanation for this difference may be related to difference in structure and scale economies between two sectors. Similarly, the share of FDI has a negative effect on the growth of commercial and service firms. This may suggest that the foreign participant does not encourage the firm to expand in terms of employment, even that the number of low-skilled or low-qualified employees will be reduced.

In short, the empirical estimation indicates that Gibrat's law should be rejected but the *hypothesis* of the impact of firm attributes on firm growth is supported for the case of the whole sample of the commercial-service sector.

5.3. Comparative analysis for different cohorts of firm size

With respect to commercial and services firms with fewer than 30 employees the results support significantly the negative relationship between firm growth and size for all models (see Table II.5). However, when inserting other firm characteristics, these effects decrease and become stable at around -0.1, weaker than those in the case of the whole sample. It maybe explained that business extension by employing more workers would be costly for micro and small firms. In comparison with the case of the whole sample, most factors (except firm size) have considerably stronger effects on firm growth. This may be related to the fact that small firms become more sensitive to economic shocks as well as internal adjustments of those firms. Similarly, to the case of the whole sample, lagged growth has a negative effect on growth in all models.

Table II.5: Determinants of Firm Growth for Micro and Small Enterprises

Dep.var.: Growth$_t$ **Exp. variables**	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Growth$_{it-1}$	-0.0290	-0.0733***	-0.0680***	-0.0648**	-0.0862***	-0.1243***	-0.1245***
	(0.032)	(0.025)	(0.026)	(0.026)	(0.024)	(0.028)	(0.028)
Ln(size) $_{it-1}$	-0.6570***	-0.2821***	-0.2514***	-0.3594***	-0.3065***	-0.1057**	-0.1049**
	(0.162)	(0.095)	(0.085)	(0.111)	(0.113)	(0.050)	(0.050)
Ln(quality) $_{it-1}$		0.1613***	0.1173**	0.1220**	0.1756***	0.0978***	0.0973***
		(0.051)	(0.053)	(0.061)	(0.053)	(0.023)	(0.023)
Ln(productivity) $_{it-1}$			0.0652*	-0.0019	0.0028	0.0181	0.0189
			(0.035)	(0.038)	(0.038)	(0.030)	(0.030)
Ln(asset) $_{it-1}$				0.0901**	0.0751*	0.1685***	0.1670***
				(0.041)	(0.059)	(0.039)	(0.039)
Ln(capitalInten) $_{it-1}$					-0.0535*	-0.0538***	-0.0542***
					(0.031)	(0.019)	(0.019)
leverage $_{it-1}$						-0.3631***	-0.3622***
						(0.062)	(0.062)
FDIshare $_{it-1}$							-0.2050*
							(0.116)
Constant	1.3989***	-0.0392	-0.4334	-0.4567	-0.4872*	-1.5012***	-1.4937***
	(0.450)	(0.291)	(0.366)	(0.300)	(0.254)	(0.209)	(0.209)
Wald chi-squ. test	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hansen test	0.38	0.73	0.52	0.86	0.82	0.11	0.10
A.-B. test AR(2)	0.66	0.82	0.79	1.00	0.76	0.60	0.60
No. of instruments	14.00	31.00	35.00	41.00	51.00	78.00	79.00
Cor. coefficient	0.15	0.28	0.30	0.30	0.30	0.36	0.36

Note: The table provides the results of the two-step system GMM estimator. (*), (**), (***) denote statistical significance at least at the 10%, 5%, and 1% levels, respectively. "Wald chi-squ. test" examines the null hypothesis that all parameters are zero. "Hansen test" is a test of the null hypothesis of the over-identifying restrictions. "A.-B. test AR(2)" is a test of the null hypothesis of no second order serial correlation. For each period, this study treats right-hand variables as endogenous ones in all regressions, with lags from t − 2 in the first-differenced equation and lags from t − 1 in the level equation as instruments. All models are regressed with time dummy variables. This study does not report these variables here. The sample consists of 6,962 observations.

With respect to labor quality, total assets and capital intensity, the effects on firm growth have the same signs as those in the case of the whole sample. The important role of quality of labor in enhancing firm growth becomes robust. In contrast, labor productivity seems ineffective in increasing firm growth when combined with other firm attributes (see columns 4-7). The results also show that increasing capital intensity for small firms is inconsistent with enhancing their growth. High capital intensity, in the definition of this study, means high value of fixed assets which may become too costly for management.

Similarly to the case of the whole sample, to access a financial resource, small firms may face a cost which is too high compared to their low revenues. Beside, the results give evidence of a negative relationship between foreign participant and firm growth. In this case, small firms may have insufficient capacity to attract FDI to improve their growth. In a nutshell, the results give strong evidence that Gibrat's law is invalid for micro and small firms.

In terms of medium-sized enterprises with more than 30 and fewer than 150 employees, there are more differences compared with the previous findings, see Table II.6. The effect of past growth on the current one switches from negative for micro and small firms to positive for medium-sized firms in the first three models. The inclusion of total assets changes that effect back to negative. This effect, however, only becomes significant when all other firm attributes are included. It indicates that the persistency of firm growth depends on its attributes.

With respect to firm size, the negative growth-size relationship is stronger than that in the case of micro and small firms and closer to that in the case of the whole sample. All these changes support an increasing speed of growth by size. However, the positive impact of labor quality on growth of medium-sized firms is weaker than that of micro and small firms. In contrast to micro and small firms, the results indicate a positive and significant effect of labor productivity on firm growth when combined with other firm attributes.

Especially, compared with results in previous part, a significant difference appears with the inverse effects of total assets, negative effect, and capital intensity, positive effect, on firm growth. It suggests that the medium-sized firms that want to expand their business should accumulate more capital. With regard to FDI share, there is more evidence of a negative relationship between this factor and firm growth. Oliveira and Fortunato (2008) found a similar result for small firms, with fewer than 50 employees.

Table II.6: Determinants of Firm Growth for Medium Enterprises

Dependent variable: Growth$_t$ **Explanatory variables**	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Growth$_{it-1}$	0.0809	0.0453	0.0462	-0.0411	-0.0345	-0.0377	-0.0402*
	(0.121)	(0.132)	(0.104)	(0.026)	(0.026)	(0.024)	(0.024)
Ln(size) $_{it-1}$	-0.2584**	-0.1895***	-0.1898***	-0.3282***	-0.2062***	-0.2468***	-0.2160***
	(0.117)	(0.070)	(0.060)	(0.088)	(0.075)	(0.073)	(0.073)
Ln(quality) $_{it-1}$		0.1604*	0.1310**	0.0939*	0.0972*	0.0833*	0.0903**
		(0.082)	(0.067)	(0.056)	(0.051)	(0.046)	(0.044)
Ln(productivity) $_{it-1}$			0.0239	0.0564**	0.0432*	0.0460*	0.0537**
			(0.028)	(0.028)	(0.026)	(0.024)	(0.023)
Ln(asset) $_{it-1}$				-0.0782	-0.0885*	-0.0857**	-0.1045**
				(0.058)	(0.052)	(0.042)	(0.041)
Ln(capitalInten) $_{it-1}$					0.0598	0.0545**	0.0580**
					(0.042)	(0.027)	(0.025)
leverage $_{it-1}$						-0.0676	-0.0476
						(0.135)	(0.112)
FDIshare $_{it-1}$							-0.2064*
							(0.120)
Constant	0.7714	0.0353	-0.0316	1.2247**	0.7179**	0.9397***	0.9030***
	(0.500)	(0.381)	(0.299)	(0.499)	(0.358)	(0.333)	(0.323)
Wald chi-squared test	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hansen test	0.76	0.29	0.47	0.18	0.13	0.19	0.23
m2 (Arel.-Bond test AR(2))	0.66	0.94	0.91	0.10	0.12	0.11	0.10
Number of instruments	25.00	31.00	41.00	40.00	56.00	69.00	80.00
Cor. coefficient	0.24	0.27	0.28	0.29	0.31	0.33	0.34

Note: The table provides the results of the two-step system GMM estimator. (*), (**), (***) denote statistical significance at least at the 10%, 5%, and 1% levels, respectively. "Wald chi-squ. test" examines the null hypothesis that all parameters are zero. "Hansen test" is a test of the null hypothesis of the over-identifying restrictions. "A.-B. test AR(2)" is a test of the null hypothesis of no second order serial correlation. For each period, this study treats right-hand variables as endogenous ones in all regressions, with lags from t − 2 in the first-differenced equation and lags from t − 1 in the level equation as instruments. All models are regressed with time dummy variables. This study does not report these variables here. The sample consists of 4,337 observations.

With respect to large enterprises with more than 150 employees, generally, most factors express stronger effects on firm growth in comparison with other cases (see Table II.7). Especially, the size has the strongest effect, with negative and significant coefficients at around -0.4, on firm growth in comparison with other sub-samples and with other factors. This provides strong evidence that Gibrat's law is invalid for the case of large firms in the commercial-service sector in Vietnam. At this cohort of size, firms with smaller size will grow faster. In terms of lagged value of firm growth, Growth $_{i(t-1)}$, coefficients in columns (1) – (3) are insignificant and positive. However, when *labor productivity* is included, they become negative and significant (at 5% and 1% level), in this sense, the past growth discourages the current growth (Chesher, 1979). The second strongest effect on firm growth belongs to labor quality. The higher the quality of employees, the faster firms could grow. This suggests that labor quality is an important determinant of firm growth, thus this factor should not be neglected. Especially, for large firms, increasing labor productivity does not enhance firm growth of employment. This implies passive learning does not improve firm growth at this cohort of size. Total assets and leverage seem to have positive effects on firm growth but insignificant. This means the effects of these factors decrease or disappear for large firms. Similar to Pfaffermayr and Bellak (2000), Oliveira and Fortunato (2008), this study does not find any evidence of the impact of foreign participant on firm growth.

Table II.7: Determinants of Firm Growth for Large Enterprises

Dep.var.: Growth$_t$ **Exp. variables**	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Growth$_{it-1}$	0.2082	0.2320	0.0207	-0.1270**	-0.1893***	-0.1820***	-0.1867***
	(0.206)	(0.186)	(0.142)	(0.059)	(0.058)	(0.061)	(0.062)
Ln(size) $_{it-1}$	-0.6654***	-0.4636***	-0.3317**	-0.4061**	-0.4644***	-0.4142***	-0.4156***
	(0.228)	(0.118)	(0.168)	(0.171)	(0.140)	(0.117)	(0.113)
Ln(quality) $_{it-1}$		0.2044**	0.3327*	0.4026***	0.3986***	0.3464***	0.3003***
		(0.096)	(0.176)	(0.149)	(0.133)	(0.126)	(0.116)
Ln(productivity) $_{it-1}$			-0.1853*	-0.3473**	-0.2544**	-0.2224**	-0.2065**
			(0.110)	(0.150)	(0.115)	(0.107)	(0.097)
Ln(asset) $_{it-1}$				0.0157	0.0716	0.0473	0.0521
				(0.152)	(0.120)	(0.105)	(0.098)
Ln(capitalInten) $_{it-1}$					-0.1340***	-0.1122**	-0.1129**
					(0.046)	(0.052)	(0.053)
leverage $_{it-1}$						0.0783	0.1177
						(0.264)	(0.245)
FDIshare $_{it-1}$							0.4858
							(1.246)
Constant	3.6604***	1.9289***	1.9891*	3.1203***	2.6108***	2.4073***	2.3550***
	(1.335)	(0.636)	(1.111)	(1.175)	(0.995)	(0.781)	(0.776)
Wald chi-squ. test	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hansen test	0.26	0.16	0.59	0.58	0.34	0.59	0.64
A.-B. test AR(2)	0.34	0.26	0.79	0.41	0.29	0.31	0.28
No. of instruments	19.00	33.00	53.00	79.00	90.00	110.00	116.00
Cor. coefficient	0.17	0.19	0.20	0.20	0.21	0.21	0.22

Note: The table provides the results of the two-step system GMM estimator. (*), (**), (***) denote statistical significance at least at the 10%, 5%, and 1% levels, respectively. "Wald chi-squ. test" examines the null hypothesis that all parameters are zero. "Hansen test" is a test of the null hypothesis of the over-identifying restrictions. "A.-B. test AR(2)" is a test of the null hypothesis of no second order serial correlation. For each period, this study treats right-hand variables as endogenous ones in all regressions, with lags from t − 2 in the first-differenced equation and lags from t − 1 in the level equation as instruments. All models are regressed with time dummy variables. This study does not report these variables here. The sample consists of 1,605 observations.

6. Conclusions

Gibrat's law still draws empirical researchers' attention due to its significantly important implications for the economic development (Teruel-Carrizosa, 2008). Studies of Gibrat's law investigate the asymmetric size distribution of firms and then suggest which source, smaller or larger firms, will exert a sharper competitive pressure in the near future on the incumbents. The results suggest which size of firms policy makers should target. Furthermore, from relationship between economic growth and employment, this dynamic analysis of firm growth provides powerful implications for policy makers[33].

This study examines the validity of Gibrat's law via investigating the relationship of firm growth and size and investigates determinants of growth of the commercial and services enterprises in Vietnam for period 2000-2007. The empirical study is set up for both simple and multiple regressions which are estimated separately for the whole sample as well as sub-samples according to different cohorts of firm size. This essay employs the dynamic panel model measured by GMM system methodology (Blundell and Bond (1998)) to produce efficient and consistent estimation.

With consistent estimators, empirical results have given some main interesting findings. Firstly, the hypothesis of Gibrat's law that firm growth does not depend on its size is rejected. Firm growth depends significantly on its size with the coefficients on firm size are all negative and significant in the whole sample, in different cohorts of firm size, in both simple and multiple models. The strongest negative effect of firm size on growth belongs to large firms. This effect seems lower for medium-sized firms and especially for small-sized ones. It implies that the relationship of firm growth and size depends on cohorts of size. The magnitude of the size effect on firm growth changes when other firm characteristics are included. Secondly, in general, the firms that experienced fast growth in the past are not likely to grow in the future. The negative relationship between the current firm growth and the past one becomes more significant after inserting other firm attributes. Therefore, the results confirm the sensitivity of the growth-size relationship to firm attributes. Interestingly, labor quality is the most useful factor in terms of boosting firm growth. Thus, investigating a new variable related to employee quality contributes to the literature on determinants of firm growth.

[33] Teruel-Carrizosa, 2008, pp. 370.

With respect to other firm attributes, effects of total assets and capital intensity are inconsistent and depend on different firm size cohorts. Effects of FDI share are almost non-significant or negative, implying that the integration and globalization pose too severe challenges for firms to grow. This is plausible because the market-oriented economy in Vietnam is young and weak thus it needs time to confront with those challenges. Besides, all estimated results are consistent by controlling unobserved heterogeneity and endogeneity. Therefore, it could be concluded that size and labor quality are main determinants of firm growth thus these factors should not be ignored in explanation of firm growth dynamics.

In conclusion, these findings lead to some main implications. With regard to enterprises, the smaller firms could grow faster than larger ones. As the result, the incumbents will suffer a stronger competitive pressure in the near future, in other words, small and medium firms (SMEs) will be the main source in pushing the market competition and the main source in creating job in the future economy (Teruel-Carrizosa, 2008). This implicates that policy makers should create favorable conditions for SMEs to further grow. Furthermore, because quality of labor is the most important determinant of firm growth, improving quality of labor should be a main task for economic policy. Besides, labor productivity of SMEs has positive effect on firm growth, consistent with the prediction of the *passive learning* model that firms learn their exact efficiency levels or relative comparison from their counterparts and then improve their size accordingly (Jovanovic, 1982). This is also an evidence of market selection for these firms, such that inefficient firms will be gradually driven out from market.

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III. TECHNOLOGY - DEVELOPMENT INVESTMENT AND FIRM PRODUCTIVITY IN DEVELOPING COUNTRIES

Abstract

This essay empirically investigates the impact of IT facilities and development investments on labor productivity to test the "productivity paradox", the interaction effects of firm-level contextual factors on this relationship, and the determinants of productivity for Vietnamese enterprises. In contrast to most of the existing literature that mainly consider patents or R&D in the relationship with firm productivity, this study investigates actual investments in two main areas: (i) Information technology facilities; (ii) development investment capital. The balanced panel dataset, which corresponds to a strong process of integration and globalization in Vietnam during the period 2001-2005, is investigated separately for the manufacturing and commercial-service sectors as well as the whole economy for comparison. Applying the fixed and random effects models, my findings imply that the "productivity paradox" does not occur for R&D for all firms, for computerization for manufacturing firms, for LAN connection and Internet situation for the commercial firms. In addition, the effects of IT facilities and development investments on labor productivity significantly depend on contextual moderating factors.

Keywords: productivity, "productivity paradox", IT investments, development investments, interaction effects, developing countries.

1. Introduction

Increasing productivity plays an extremely important role in a firm's business strategy as well as economic growth. From a microeconomic perspective, an increase in productivity is deemed to improve profitability (Ghosal and Nair-Reichert, 2009). From a macroeconomic perspective, firms with higher productivity contribute more to GDP and improve economic growth. In advanced economies, the growth of productivity depends on technological innovation (Brynjolfsson and Hitt, 2003). Furthermore, information technology (IT) has its greatest impact on productivity (Malone et al., 1989; Gurbaxani and Whang, 1991; Bresnahan, 1997). This category of investments has impacts that are distinctly different from those of other categories. Not only can IT be used directly as an important production technology to improve significantly labor productivity, but it is also employed as an efficient technology for coordination to improve information-processing capability (Malone et al. 1989; Dedrick et al., 2003; Kobelsky et al., 2008). However, there is a controversy of the relationship between IT and productivity, which is of interest not only for businessmen but also policy makers.

In 1993, Brynjolfsson introduced the "productivity paradox" based on the evidence of "the sharp drop in productivity" that "roughly coincided with the rapid increase in the use of IT" in the US economy[34]. A great number of researchers found no relationship

[34] Brynjolfsson (1993, pp. 67)

between IT and productivity (Loveman, 1994; Strassmann, 1997; Menon and Lee, 2000; Hu and Quan, 2005). However, mixed results are also found in many papers (Weill, 1992; Mahmood and Mann, 1993; Hitt and Brynjolfsson, 1996; Prattipati and Mensah, 1997; Devaraj and Kohli, 2000; Osei-Bryson and Ko, 2004; Sriram and Stump, 2004). Furthermore, technological innovation has recently been considered an accelerator for firm productivity by other numerous studies (Brynjolfsson and Hitt, 1995; Menon and Lee, 2000; Kudyba and Diwan, 2002a, 2002b; Kudyba and Vitaliano, 2003; Hu and Quan, 2005; Lee and Kim, 2006). While most of these studies focus on the case of developed countries, few papers investigate the case of developing countries, and most of that did have presented mixed findings (Tam, 1998; Teo and Wong, 1998; Huang et al., 2006). Therefore, there is a recent call for further investigations of the "productivity paradox" for the case of developing countries.

Vietnam offers an appropriate laboratory among developing countries to investigate the "productivity paradox" and examine determinants of firm productivity. As a typical developing country in Asia, Vietnam has implemented an economic transition from the centrally planned economy to the market-oriented one. During this period, Vietnam has experienced tremendous changes in economic structure which have enhanced the growth of enterprises (Baughn et al., 2004), and international integration, such as joining the WTO in 2006. While Asia has recently become one of the world's three major economic centers, Vietnam has considered one of the most prosperous and successful developing countries in Asia, with the growth rate of real GDP by 7.4% p.a. over the 1990s (Oostendorp et al., 2009), and by 7.6% p.a. during the period 2000-2007 (GSO, 2009). Recently, many domestic enterprises have actively accelerated the application of technology, invest in research and development, computerize business and production processes, renovate equipment and construction, and improve labor skills and qualifications. As the result, the labor productivity growth in Vietnam has been so outstanding as to be higher than other ASEAN countries during the period 2000-2008[35]. However, labour productivity in absolute terms is still low, even ranking the second lowest among ASEAN countries in 2008, thus making it "one of the biggest challenges in the labour market in Viet Nam" [36].

[35] Labour and Social Trends in Viet Nam 2009/10, 2010.
[36] http://vietnambusiness.asia/productivity-low-despite-high-gains/

Therefore, this essay aims to test the "productivity paradox", investigates determinants of firm productivity, and evaluates interaction effects of firm-level contextual factors on the relationship between IT facilities/development investments and firm productivity for the case of firms in a developing country, namely Vietnam. The study focuses on: (i) whether the "productivity paradox" exists; (ii) whether there are interaction effects of firm-level contextual factors on the relationship between IT facilities/development investments and productivity; (iii) whether this relationship is consistent among firms from different sectors.

The essay presents several contributions. In contrast to most of the existing literature that mainly consider patents or R&D in the relationship with firm productivity[37], the study investigates actual investments in two main areas: (i) Information technology facilities, including computer, internet access, and LAN connection; (ii) development investments, classified as investment portfolios, including investments for equipment and machinery; construction; and research and development. In addition, the study attempts to bridge the gap of the recent research on the mechanism by which IT investments pay off in higher productivity (Dedrick et al., 2003). The study explores contextual variables to identify this mechanism. Moreover, the employed data cover multi-sector and multi-size, which will help to close the gap in recent research that mainly focuses on single sector and large firms (Dedrick et al., 2003). Furthermore, the data cover the period 2001-2005, an episode of strong integration and globalization processes in Vietnam. In addition, the essay employs fixed and random effects models to take into account the individual and time effects.

The rest of the essay is organized as follows. Section 2 is devoted to an overview of the literature and research hypotheses. The next section briefly describes the methodology employed including model, variables, and data. Section 4 presents the empirical results and analysis. The final section concludes and points out some policy implications.

2. Literature review and research hypotheses

In broad definition, IT investments include "investments in both computers and telecommunications and in related hardware, software, and services"[38]. IT investments are distinct from other genres of investments in their dual roles in a firm, that is, on one hand, similar to other kinds of capital, IT investments can directly support productivity

[37] Ghosa and Nair-Reichert, 2008
[38] Dedrick et al., (2003, pp. 4)

in the role of a production technology (Dedrick et al., 2003). On the other hand, IT investments have their distinct impact in the role as an efficient technology for coordination (Malone et al., 1989; Dedrick et al., 2003; Kobelsky et al., 2008).

However, based on the evidence of "the sharp drop in productivity" that "roughly coincided with the rapid increase in the use of IT"[39] in the US, Brynjolfsson introduced the "productivity paradox" in 1993. Based on main findings, the literature on this issue could be divided into two stages[40]. The first part of research, from the mid 1980s to the mid 1990s, has findings consistent with the "productivity paradox", i.e. mainly negative or insignificant impacts of IT investments on productivity. The second one gradually refutes this paradox by presenting positive effect of IT investments on productivity, from the mid 1990s till now.

In the first period, most papers found no positive and significant effect of IT investments on productivity at the firm or industrial levels or the whole economy (Roach, 1987, 1989; Strassmann, 1990). In 1992, for instance, Weill found no relationship between the investments in informational and strategic information system (IS) and business productivity in valve manufacturing firms. Similarly, Loveman (1994) investigated the benefits generated by IT investments in manufacturing firms between 1978 and 1984 and did not find any evidence of a positive association of IT investments with firm output.

The later empirical studies provide strong evidence of a positive correlation between IT investments and firm productivity. Brynjolfsson and Hitt (1995, 1996), and Lichtenberg (1995) employed production-function estimates and indicated that output elasticity for computer significantly exceeded its capital cost. Furthermore, Hu and Plant (2001) showed that IT investments in the preceding years increased firm productivity in the subsequent years. Similarly, Brynjolfsson and Hitt (2003) concluded that computerization improved productivity and output growth. Ko et al. (2008) employed MARS techniques, and found that IT stock was the most crucial determinant of productivity. In addition, Lee and Kim (2006) concluded that IT investments had positive impact on firm financial performance. In 2008, Kobelsky et al. studied IT spending from 1992–1997 to examine causality between IT investments and the earning volatility in the future. He found that this causality was highly contingent upon

[39] Brynjolfsson (1993, pp. 67)
[40] Loukis et al., (2009, pp 195)

some firm level contextual factors, including sales growth, unrelated diversification, and size. Ghosal and Nair-Reichert, (2009) evaluated the role of investments in innovation and modernization on firm productivity. They concluded that firms that invested more in modernization achieved higher productivity; and investment transactions in digital monitoring and information technology devices particularly improved productivity.

An explanation for those contradictory findings in two periods may be resulted from IT investments' dual role (Dedrick et al., 2003). IT investments can enhance the capability of processing information, enabling firms to respond more quickly and efficiently to contextual uncertainty, and reducing volatility in productivity, however, IT investments have a significant risk of implementation, increasing this volatility (Kobelsky et al., 2008). Therefore, how the effect of IT investments on productivity changes after controlling contextual moderating effects[41] is one of the central questions of the recent productivity study. Besides, most studies only focus on developed countries, on the impacts of R&D and patents, and apply a simple method like OLS regression to examine the "productivity paradox". Another common shortcoming of most studies is that they are not often confined to the reform era, thereby considerably delimiting empirical appeal of reform (Ghosh, 2009). Especially, no research has hitherto provided an analysis with comprehensive contextual variables at firm level that would allow us to understand the mechanism by which firms can benefit from IT investments. Thus, the recent study attempts to cover those issues via examining below hypotheses:

- *Hypothesis 1: The "productivity paradox" does not occur, that is, IT facilities and development investments have positive effects on firm productivity.*
- *Hypothesis 2: Favorable firm attributes and globalization factors improve productivity and the relationship between IT facilities - development investments and productivity.*
- *Hypothesis 3: The relationship between IT facilities - development investments and productivity is moderated by different economic contexts*[42].
- *Hypothesis 4: This relation is not consistent among different sectors.*

[41] According to Jaccard et al. (2003), there are some main types of relationship in statistics. A *direct* causal relationship is one in which a variable, *X*, is a direct cause of another variable, *Y*. An *indirect* causal relationship is one in which *X* exerts a causal impact on *Y*, but only through its impact on a third variable, *Z*. A *moderated* causal relationship, or interaction effects, is one in which the relationship between *X* and *Y* is moderated by a third variable, *Z*.

[42] Economic contexts here are at firm level and time-variable.

Focusing on the relationship between IT facilities/development investments and productivity, the research with the most important contributions conducted in the last two decades is summarized in the below Table III.1[43].

[43] See Osei-Bryson and Ko (2004, pp. 3), Lee and Kim (2006, pp. 63 - 69), and Ko et al. (2008, pp. 4, 5, 16) for more literature review.

Table III.1: Empirical Studies of "Productivity Paradox"

Study	Research method	Dataset/ period	Sector	Level of analysis/ type of country	Productivity/ performance measures	IT Measures	Results
Weill (1992)	Hierarchical regression	33 firms during 1982–1987	Manufacturing	Firm/US-developed	Labour productivity; return on assets, and sales growth.	Transactional IT, strategic IT, and informational IT investments	Early adoption of strategic IT could lead to a significant success. While transactional IT has a positive relationship with performance, informational IT does not. Context variable, such as conversion effectiveness, is an important moderator of the relationship between firm strategic IT investments and its performance.
Mahmood and Mann (1993)	Pearsonian correlation and canonical correlation	Computerworld 's list of ''the 100 most effective users of information systems'' for 1989	Most effective users of information systems	Firm/US-developed	Return on sales, return on investment, sales by employee, and sales by total assets, growth in revenue	IT budget per revenue; value of organization's IT per revenue; percentage of IT budget which is spent on the training for IT staff; percentage of IT budget which is spent on staff; number of personal computers and terminals per total employees.	There is a weak relationship between individual IT measure and individual performance variables while there is a strong one between the combined IT measure and performance variables.
Brynjolfsson and Hitt (1996)	Ordinary Least Squares Regression; Iterated	367 large firms during 1987–1991	All industries	Firm/ data from International Data Group	Total Sales, Value added	Computer capital; IS Staff.	IS spending has a statistically significant contribution to output of firms. Although IT investments have a positive effect on productivity and consumer

	Seemingly Unrelated Regressions			(IDG) survey. /US-developed			value, they have no effect on business profitability.
Dewan and Min (1997)	Constant elasticity of substitution (CES)	102-304 firms during 1988–1992	Manufacturing + service	Large U.S. firms/Developed	Sales, operating income, annual value added	IT capital: computer capital, capitalized value of IS labor expenses.	IT capital is considered a substitute for other inputs, including capital and labor. Findings indicate that returns on IT capital exceed that on labor.
Shao and Lin (2002)	Parametric econometric approach; Cobb–Douglas/ translog production frontiers	370 firms during 1988–1992	Manufacturing + service	Firm-from International Data Group (IDG) survey/US-developed	Value-added output	IT investments: IT hardware; IS staff expenses	IT investments contribute significantly to the productivity growth via increasing technical efficiency.
Kudyba and Diwan (2002)	OLS regression analysis	1995-1997 (348 firms in 1995; 355 in 1996; 188 in 1997)	Top 500 corporate users of information technology	Firm/US-developed	Total Sales, value added	IT capital; IT labor; IT budget; IT flow; IS budget .	IT investments have a positive impact on productivity. High IT-intensive industries improve returns to IT capital.
Brynjolfsson and Hitt (2003)	OLS regression analysis	527 large firms during 1987-1994.	Multi-sector	Firm/US-developed	TFP; value added	Computer stock, computer capital	Computerization enhances significantly productivity and output growth of firms in the short-run (one-year differences). In long run (five-to seven-year differences), the contributions of productivity and output combined with computerization are higher (five-fold).
Doms et al. (2003)	OLS regression analysis	Retail firms during 1992-1997: 17,129 firms in 1992	Retail Trade	Firm/US-developed	Labor productivity and productivity	Intensity of computer and total capital investment.	IT investment intensity has a positive impact on the growth of firm productivity.

		and 1,082,855 in 1997			growth		
Osei-Bryson and Ko (2004)	MARS	370 firms during 1988–1992	Multi-sector	Firms /US-developed	Gross sales	IT capital: central processors plus value of P/Cs and terminals; IT labor	IT investments increase significantly productivity only when their values exceed a threshold.
Hu and Quan (2005)	Granger causality model	240 firms during 1970-1999	Multi-sector	Eight industries over a 30-year period/US-developed	GDP per employee for each industry	IT investments	At the industry level, IT investments increase productivity. IT investments improve productivity growth of firms in the transportation and manufacturing industries, but not in finance industry. There are two contextual moderators affecting this effect, namely value-chain information intensity and product information intensity.
Lee and Kim (2006)	Weighted Least Square regression, Pearson correlation analysis	81 firms during 1991-1997	Multi-sector	Firm /US-developed.	ROC, ROE, Profit margin, Sales growth, earnings per share growth	IT budget	IT investments have a positive impact on the financial performance of firms. The higher IT-intensive industries contribute higher returns on IT investments. An immediate effect of IT is smaller than the lag one of IT.
Aral and Brynjolfsson (2006)	OLS, Logit regressions	623 large, public firms during 1998 - 2005	Public firms	Firm/US-developed	Labor productivity, inventory turnover, ROA, ROE, leverage, profit margin, collection efficiency, asset utilization.	Main enterprise system suites: Customer Relationship Management, Enterprise Resource Planning, Supply Chain Management.	There exists simultaneity in the relationship between IT and firm performance: firms that gain benefit from IT investments will react by spending more in IT.

Anagnostop-oulou and Levis (2008)	OLS regression	2182 Firm during 1990–2002	Nonfinancial firms	2182 Firm/UK-developed	Sales, Gross Income, profit after tax	R&D-intensity: R&D/Sales or R&D/Total assets	R&D intensity has a contribution to consistent growth in firm gross income and sales, but only in the case that firms engage in the technology-intensive industry.
Ko et al. (2008)	MARS	Top 500 corporate users of IT in the United States. for the year from 1994 to 1997	Top 500 corporate users of IT	Firm/US-developed	Value Added	IT Stock (hardware, software, telecom, and others which are relevant)	IT stock is the most crucial determinant of productivity, however, it is only important as an interaction variable which is combined with Non-IT Labor, Non-IT Capital.
Kobelsky et al. (2008)	OLS regression	Information week 500 data during 1992–1997	Multi-sector	Firm/US-developed	Earnings	Capital expenditures are spent for hardware, software, and IT personnel.	The effect of IT investments on future earnings is highly contingent upon some firm level contextual factors, including firm size, unrelated diversification, and. sale growth.
Kim et al. (2009)	OLS regression	China's IT TOP 100 firms in 2004	Electronics industry.	Firm/China - developing	ROA, ROE, Profit margin, Sales growth, earnings per share growth	Ratio of IT budget to sales; total investments in computer software, hardware, communications systems, and devices; the IT personnel.	IT investments enhance firm performance in China. The size and the direction of this impact are similar to those in the United States.
Loukis et al. (2009)	OLS, Cobb–Douglas production	137 big firms in 2002	Manufacturing business	Firms /Greece-developing	Total sales revenue	Investments on hardware, software, and communication technology.	There is evidence of a significantly positive contribution of IT investments to firm output.
Ghosal and Nair-Reichert (2009)	OLS regression	19 firms during 1996–2003	Global pulp and paper industry	Firm/North America and Europe	Productivity and firm growth	Investment transactions in main areas: mechanical, chemicals, monitoring devices, information technology.	The more firms invest in modernization the higher productivity they achieve, especially after controlling other firm-specific variables.

Table III.1 expresses that numerous empirical studies have been examined the relationship between IT investments and firm productivity/performance at different methodologies, at various level of analysis, at a range of dependent variables, at more and more comprehensive independent variables, and under diversified contexts. In general, they found a significant effect of IT on productivity only in developed countries, not in developing countries. The reason may be that developing countries with higher capital costs and lower unit costs of labor face more difficulties for capital-labor substitution (Dedrick et al., 2003).

3. Methodology

3.1. Research model

Fixed and random effects models are applied separately for different groups of independent variables, including IT facilities, development investments, firms' attributes, economic environment, and contextual variables.

Following Brynjolfsson and Hitt (1996), the regressions without *contextual moderators* are firstly estimated to evaluate whether the *direct effects* of IT facilities/development investments on productivity are similar to the prior findings (Dewan et al., 2007; Kothari et al., 2002; Kobelsky et al., 2008). The standard regression model for examining the "productivity paradox" can be formulated as follows:

$$LP_{it} = \alpha_i + \delta_t + \beta_1 IT_{it} + \varepsilon_{it} \quad \text{(III-1)}$$

Where LP_{it} is labor productivity of firm i at time t. α_i and δ_t represent individual and time effects, respectively. IT_{it} denotes group of IT facility variables of firm i at time t, including the number computer per employee (Co_{it}), internet access (In_{it}) and LAN connection (La_{it}). My first *hypothesis* is that *IT facilities and development investments have positive effects on firm productivity* which means that β_1 has a positive value ($\beta_1 > 0$). ε_{it} is a random disturbance and is assumed to be normal, independent and identically distributed (IID) with $E(\varepsilon_{it}) = 0$ and $\text{var}(\varepsilon_{it}) = \sigma_\varepsilon^2 > 0$.

To answer the second *hypothesis*, "favorable firm attributes and globalization factors improve productivity and the relationship between IT facilities - development investment and productivity", variables of internal-firm factors (firm's attributes) and external-firm factors (globalization variables) are inserted:

$$LP_{it} = \alpha_i + \delta_t + \beta_1 IT_{it} + \beta_2 At_{it} + \beta_3 Glo_{it} + \varepsilon_{it} \quad \text{(III-2)}$$

In (III-2), At_{it} represents firm attributes, such as capital intensity, total assets, total fixed assets and long-term investments, labor quality and leverage. Glo_{it} illustrates macroeconomic/globalization factors, including market size and trade growth.

Following Kobelsky et al. (2008), the third *hypothesis,* the relationship between IT facilities and firm productivity is moderated by different economic contexts is examined. Similarly to Kobelsky et al. (2008), this study also focuses on firm-level moderating effects. Thus contextual moderator factors are inserted in the model, yielding the following formula:

$$LP_{it} = \alpha_i + \delta_t + \beta_1 IT_{it} + \beta_2 At_{it} + \beta_3 Glo_{it} + \beta_4 (Co_{it} * Mo_{it}) + \varepsilon_{it} \quad \text{(III-3)}$$

Function (III-3) answers the central question that how the effect of IT facilities on productivity changes after controlling contextual moderating effects. The multiplicative term, $Co_{it} * Mo_{it}$, is said to encompass the interaction effect, or presence of a moderated relationship (Jaccard et al., 2003). Mo_{it} includes firm attributes, LAN connection, and internet access. To evaluate moderating relationship, firstly, the essay follows Kobelsky et al. (2008) to investigate firm attributes, including capital intensity, firm size, and lobour quality. Secondly, the essay attempts with two IT facilities, the internet access and LAN connection, because these factors have an intimate relationship with computer. These factors could not function without computer and represent the level and scale of accessing IT. Furthermore, these factors measure the extent level to which firms have made IT available to their managers and employees. The value of β_4 indicates how the relationship between labor productivity and IT facilities varies across different economic contexts.

Similarly, the above steps are applied for variables of development investments, including total development investments; investment portfolios, including investments for equipment and machinery; construction; and research and development as follows:

$$LP_{it} = \alpha_i + \delta_t + \gamma_1 DI_{it} + \gamma_2 At_{it} + \gamma_3 Glo_{it} + \gamma_4 (RD_{it} * Mo_{it}) + \varepsilon_{it} \quad \text{(III-4)}$$

Where DI_{it} is the group of development investment variables of firm i at time t, including total development investments (To_{it}), R&D investment rate (RD_{it}), Equipment investment rate (Eq_{it}), Construction rate (Cs_{it}).

Finally, formulas (III-3) and (III-4) are applied separately for two main sectors in economy, the manufacturing and the commercial-service sectors, to test the final hypothesis as well as to facilitate the comparison with other studies' results.

3.2. Variables

In this study, dependent variable is labor productivity which is measured by total sales divided by number of employees. Compared with multifactor productivity, this measurement is more advantageous in terms of comparability, that is, it scales the outputs of firms in all industries to the comparable one; and in terms of more sensitive response to any change of IT investments (Triplett, 1999). It is reason why many IT investment studies have used this definition (Kraemer and Dedrick, 1994; Doms et al., 2003; Hu an Quan, 2005; Aral and Brynjolfsson, 2006). Regarding independent variables, they are theoretically driven, see Table III.2.

This study employs the IT concept concerning technology facilities, namely computer, internet access, and LAN connection. The first facility, computer, is "best described as a general-purpose technology"[44]. The second facility, internet access, is one of the most effective ways to communicate, update, collect, and exchange information all over the world. The third facility, LAN connection, helps to exchange powerfully information within local area/company. While the number of computers per employee measures the coverage of which users can access to IT, the internet access and LAN connection represent the level and scale of accessing IT and estimate the level to which a firm makes IT available.

Moreover, in contrast to most of the existing literature that mainly consider patents or R&D in the relationship with firm productivity[45], this study employs the actual development investment portfolios, including investments for research and development (R&D); equipment and machinery; and construction. R&D investment has been considered a key measure of the current condition of technical knowledge of firms (Griliches, 1979). The higher level of R&D a firm invests in, the more innovative and efficient it is expected. This essay will focus on whether innovative activity – in the sense of more R&D investment–delivers gains in productivity. In this essay, expenses for R&D are used to conduct mainly scientific and technological research, and technical and innovation programs. Expenses for equipment and machinery are spent

[44] Brynjolfsson and Hitt (2003, pp. 793)
[45] Ghosa and Nair-Reichert, 2008

mainly on purchasing, operating, and repairing technological equipment and machinery. Expenses for basic construction are invested mainly for designing and building projects.

Table III.2: Variables

Variable name	Explanations
Dependent variable	
Labor productivity	Labor productivity is measured by total sales divided by number of employees.
Independent variable	
IT facilities	
Computer per capita (Com)	Number of computers per employee
LAN connection	Dummy variable: 1 if LAN connection is available; 0: otherwise
Internet access	Dummy variable: 1 if Internet is available; 0: otherwise
Development investment	
Total development investments	Total investment capital for development
R&D investment rate (RD)	The ratio of R&D investment per total development investments
Equipment investment rate	The ratio of equipment and machine investment per total development investments
Construction rate	The ratio of construction investment per total development investments
Firm's attributes-contextual moderators	
Capital intensity	Capital intensity is measured by total fixed assets divided by number of employees.
Firm size - Total assets per employee	Book value of total assets divided by number of employees
Firm size - Total fixed assets and long term investments	Book value of total fixed assets and long term investments
Labor quality	Total incomes of employees per number of employees.
Leverage	The book values of total liabilities divided by total assets
Globalization factors	
Market size - competitiveness	Number of enterprises in each industry
Trade growth	Annual trade growth of economy

In terms of firm's attributes, the study employs some crucial internal factors on which the firm depends for survival. Because this study employs labor productivity (the total sales divided by total labor) as a proxy of firm performance, capital intensity (the ratio

of capital to labor), is considered an important control variable[46]. Besides, labor quality is also a considered independent variable because it is a key determinant of international differences in productivity (Mitchell, 1968). Furthermore, under the process of trade liberalization, Vietnamese enterprises seriously demand for skilled labor. Following Wakelin (1998), the study uses average wage, the total earnings of employees per number of employees, to capture the labor quality. Furthermore, firm size may moderate the effect of IT/development investments on productivity. Besides, the increasing competition under the process of trade liberalization may cause a financial risk which lead to an adjustment of financial structure. In this study, leverage as a proxy for the financial risk is measured by the book values of total liabilities divided by total assets.

In addition, in the present study, the globalization effects on an economy are expressed mainly by trade growth of the whole economy and competition level. In this paper, the competition level is measured by the number of enterprises in each industry. All financial variables are deflated by the annual consumer price index (CPI). Variables including labor quality, labor productivity, total assets, total fixed assets & long-term investment, capital intensity, market size are expressed *in logarithm* form.

3.3. Data

The panel firm-level data employed in this essay are extracted from National census of enterprises in Vietnam during the period 2001-2005. This census is conducted by Vietnam Government Statistics Organization. It investigates all enterprises, namely State owner Enterprises, joint stock companies, private enterprises, co-operatives, limited liability companies, partnerships, and foreign-invested enterprises. These enterprises operate throughout the country in all sectors of the national economy. For the purpose of empirical research, cleaning procedures are followed. Observations with either non-positive or missing values for the variables employed (number of employees, earning, sales, total assets, fixed assets, and liabilities) are excluded. Besides, the data are limited to surviving enterprises to pave the way for analysis of the persistence of productivity during the observed time. Finally, the used dataset is a balanced panel data with 15,140 observations of 3,028 firms with descriptive statistics in Table III.3.

[46] The reason is that a firm with a higher capital-stock usually produce higher level of output for a given amount of labor, leading higher labor productivity (Ghosal and Nair-Reichert, 2009, pp. 540).

Table III.3: Descriptive Statistics

Description	Mean	Std. Dev.	Minimum	Maximum
Labor productivity (millions VND)	360.87	858.55	0.336506	40,748
Computer per capita	0.10	0.17	0	3
LAN connection	0.40	0.49	0	1
Internet access	0.58	0.49	0	1
Total development investment (millions VND)	8,676.87	46,308.00	0.999001	3,673,061
R&D investment (RD) (millions VND)	4,651.02	31,420.50	0	2,915,863
Equipment investment (millions VND)	1,841.89	15,960.23	0	1,157,217
Construction investment (millions VND)	2,209.30	19,586.69	0	1,573,073
Capital intensity	62.25	223.09	0.02	8,859
Total assets per employee	108.59	392.71	0.02	16,035.65
Labor quality	15.71	14.26	0.035121	350
Total fixed assets & long-term investment (millions VND)	34,899.47	153,126.60	0.796813	6,368,266
Leverage	53.89	27.81	0	100
Market size - competitiveness	1,527.60	993.18	24	5,936
Trade growth	1.60	0.46	1.037	2

4. Empirical results and discussion

This section applies the fixed and random effects models for simple and multiple regressions for Vietnamese enterprises. The estimates are displayed from the simple model to the multiple ones by inserting stepwise groups of variables to evaluate the change of factor effects in various economic contexts. The output is presented separately for IT facilities and development investments, the manufacturing and commercial-service sectors, to facilitate comparisons with each other.

4.1. Relationship between IT facilities and labor productivity

This section focuses on empirical results of the relationship between labor productivity and IT facilities (see Table III.4). Model (1) presents the effects of IT facilities on productivity without other factors' effect. Inserting more effects of firm's attributes, model (2) evaluates how the relationship between IT facilities and productivity changes. Model (3) investigates how this relationship changes under the effects of globalization factors. Final model illustrates how contextual factors moderate this relationship.

Table III.4: Effects of IT Facilities on Productivity

Dep. Var.: Labor Productivity	IT	Firm's features	Globalization factors	Context
Exp. Vars.	**(1)**	**(2)**	**(3)**	**(4)**
IT facilities				
Computer per capita (Com)	0.9817***	0.2331***	0.0926*	0.3587*
	(0.061)	(0.054)	(0.054)	(0.204)
LAN connection	0.0689***	0.0591***	0.0175	0.0305**
	(0.014)	(0.012)	(0.013)	(0.015)
Internet situation	0.0599***	0.0581***	0.0257*	0.0360**
	(0.015)	(0.013)	(0.013)	(0.016)
Firm's features				
Capital intensity		0.1534***	0.1270***	0.1428***
		(0.012)	(0.012)	(0.014)
Labor quality		0.4108***	0.3803***	0.3867***
		(0.010)	(0.010)	(0.011)
Firm size 1[x]		0.2846***	0.3505***	0.3514***
		(0.015)	(0.016)	(0.017)
Firm size 2[xx]		-0.2527***	-0.3349***	-0.3403***
		(0.011)	(0.012)	(0.012)
Leverage		0.3408***	0.2849***	0.2855***
		(0.026)	(0.026)	(0.026)
Globalization factors				
Market size			0.0480***	0.0529***
			(0.015)	(0.015)
Trade growth			0.1296***	0.1149***
			(0.012)	(0.012)
Moderating effects				
Com*LAN				-0.1413**
				(0.072)
Com*Internet				-0.1971*
				(0.111)
Com* Capital_intensity				-0.1606***
				(0.049)
Com*Firm_size_1				-0.2225***
				(0.060)
Com*Labor_quality				-0.1122***
				(0.041)
Com*Firm_size_2				0.2326***
				(0.038)
Constant	4.7518***	4.2279***	4.2894***	4.2232***
	(0.011)	(0.070)	(0.147)	(0.152)
Observations	15140	15140	15140	14805
R^2	0.028	0.282	0.300	0.303

Note: Standard errors are in parentheses. (*), (**), and (***) denote statistical significance at least at the 10%, 5%, and 1% levels, respectively. ([x]), ([xx]) denote Total assets per employee, Total fixed assets & long-term investment, respectively. Model (1) presents effects of IT facilities on Productivity without other factors' effect. Model (2) evaluates how the relationship between IT facilities and Productivity changes under effect of firm's attributes. Model (3) investigates how this relationship changes under effect of Globalization factors. Final model illustrates how contextual factors moderate this relationship.

In Table III.4, generally, all IT facilities have positive effects on labor productivity, thus this supports the first hypothesis. Their strongest effects are expressed in model (1). These effects gradually decrease in models (2-3) under circumstance of firm's features and globalization factors, even effect of *LAN connection* turns to insignificant in model (3). Particularly prominent is the role of computer in increasing productivity. In all models, the coefficients of *Com* are significant positive and strongest compared with other IT facilities. In the model 4, in combination with all other factors, the coefficient reaches the value of 0.3587, the second highest compared with other effects in this model (the strongest effect, with value of 0.3867, belongs to labor quality). In other words, among various significant factors, using computer contributes mainly to productivity.

The models (2-3) give the answer for the second hypothesis[47]. In the context of main firm's attributes, all IT facilities' effects on labor productivity decrease. In other words, these evidences do not support the second hypothesis. However, all IT facilities' effects are still significant and positive. Similarly to computers, capital intensity, total assets, labor quality, and leverage significantly improve productivity. However, in the context of globalization, in model (3), LAN connection's effect on productivity turns to insignificant. The reason may be that LAN connection only functions within local area/company, while the globalization requires no limit in exchanging information, thus its contribution becomes insignificant.

With respect to the third *hypothesis* that the relationship between IT facilities and productivity is moderated by different economic contexts, model (4) provides evidence to support it. In this model, all IT facilities' effects are significant and positive and seem higher compared with those in models (2-3). In model 4, other firm's attributes remain their significant signs and strength compared with those in the previous models. Besides, all contextual factors are significant, indicating the third hypothesis is valid. In addition, most moderator variables have significant and negative impacts on the relationship of IT facilities on labor productivity, except fixed assets and long-term investments. Generally, it implies that these variables reduce the effects of IT facilities on productivity. More computers connected in LAN seem still not to push up the labor productivity. While total assets have negative moderating effect, fixed assets and long-

[47] *Favorable firm attributes and globalization factors improve productivity and the relationship between IT facilities - development investments and productivity.*

term investments have positive one, it could be explained that the negative moderating impact may be resulted from short-term investments.

In short, IT facilities' impacts on productivity are sensitive with different contexts. However, it still gives strongly opposite evidences to the productivity paradox for Vietnamese enterprises. Similarly to computerization, total assets per employee and labor quality are considered important determinants of productivity.

4.2. Relationship between development investments and labor productivity

In attempt to avoid the mis-measurement of IT as mentioned by Brynjolfsson (1993)[48], the study replicates the above empirical analysis for development investments, including investment for R&D; equipment and machinery; and construction. In other words, this section presents the impact of development investments on labor productivity. In Table III.5, model (1) presents effects of development investments on productivity without other factors' effect. Model (2) evaluates how the relationship between development investments and productivity changes under the effects of firm's attributes. Model (3) investigates how this relationship changes under the effects of globalization factors. The final model illustrates how contextual factors moderate this relationship.

Table III.5 shows that, in general, a firm with higher total development investments, especially with higher share of R&D investment, will have higher labor productivity. While equipment investment rate has negative effect (models 2-4), construction investment rate has insignificant and positive effect on labor productivity (models 3-4). It implies that to improve labor productivity, a firm should invest more in R&D rather than in other kinds of development investments. The effect of the share of R&D investment on labor productivity is significantly stronger than that of other shares of development investment portfolios. Therefore, the first hypothesis is only supported by the results of total development investments and R&D investment rate.

[48] Brynjolfsson (1993) postulate that there may be four reasons for the productivity paradox: (1) Mis-measurement of outputs and inputs; (2) Lags due to learning and adjustment; (3) Redistribution and dissipation of profits; (4) Mismanagement of information and technology.

Table III.5: Effects of Development Investments on Productivity

Dep. Var.: Labor Productivity	Dev. Inv.	Firm's features	Globalization factors	Context
Exp. Vars.	(1)	(2)	(3)	(4)
Development investments				
Total Development investments	0.0074**	0.0006	0.0066**	0.0068**
	(0.003)	(0.003)	(0.003)	(0.003)
R&D investment rate (RD)	0.1997***	0.1386***	0.0737***	0.3445***
	(0.015)	(0.013)	(0.014)	(0.045)
Equipment investment rate	-0.0037	-0.0374**	-0.0407**	-0.0554***
	(0.021)	(0.018)	(0.018)	(0.018)
Construction investment rate	0.1022***	0.0774***	0.0189	0.0120
	(0.022)	(0.019)	(0.020)	(0.020)
Firm attributes				
Capital intensity		0.1410***	0.1240***	0.1076***
		(0.012)	(0.012)	(0.015)
Labor quality		0.3971***	0.3747***	0.4192***
		(0.010)	(0.010)	(0.013)
Firm size^{x}		0.3251***	0.3653***	0.3514***
		(0.015)	(0.015)	(0.019)
Firm size^{xx}		-0.2901***	-0.3512***	-0.3354***
		(0.011)	(0.012)	(0.013)
Leverage		0.3261***	0.2807***	0.2766***
		(0.026)	(0.026)	(0.026)
Globalization factors				
Market size			0.0433***	0.0523***
			(0.015)	(0.015)
Trade growth			0.1142***	0.1038***
			(0.012)	(0.012)
Moderating effects				
RD*LAN				0.0333**
				(0.013)
RD*Internet				0.0219
				(0.014)
RD*Capital_intensity v				0.0202
				(0.016)
RD*Labor_quality				-0.0759***
				(0.013)
RD*Firm_size_1				0.0297*
				(0.017)
RD*Firm_size_2				-0.0341***
				(0.007)
Constant	4.6981***	4.4562***	4.4049***	4.2198***
	(0.030)	(0.070)	(0.146)	(0.150)
Observations	15140	15140	15140	14805
R^2	0.027	0.291	0.304	0.308

Note: Standard errors are in parentheses. (*), (**), and (***) denote statistical significance at least at the 10%, 5%, and 1% levels, respectively. (^{x}), (^{xx}) denote Total assets per employee, Total fixed assets & long-term investment, respectively. Model (1) presents effects of development investments on Productivity without other factors' effect. Model (2) evaluates how the relationship between development investments and Productivity changes under effect of firm's attributes. Model (3) investigates how this relationship changes under effect of Globalization factors. Final model illustrates how contextual factors moderate this relationship.

However, the models (2-3) imply that under the effects of firm's attributes and globalization factors, the positive effects of development investments decrease, which is opposite to the second hypothesis. In model 2, while positive coefficient of total development investments turns to insignificant, negative effect of equipment investment rate becomes stronger. Besides, firm's attributes have similar effects on labor productivity to those in the previous section. In model 3, under the effects of globalization factors, the effects of development portfolios fluctuate slightly. The effect of total development investments increases but the effect of R&D investment rate turns to decrease weakly. Besides, firm's attributes have similar effects to those in model 2. In addition, globalization factors have significant and positive impacts on productivity. Thus, the second hypothesis is not supported.

Finally, the model (4) expresses that the *third hypothesis*[49] is supported. The effect of R&D investment rate on labor productivity depends on some moderators: LAN connection, total assets, labor quality, total fixed assets and long-term investments due to their significant coefficients. While LAN connection and total assets support the effects of R&D investment rate on labor productivity, total fixed assets and long-term investments, and labor quality do not. It may suggest that LAN connection is a useful way for members in a R&D project to contact and exchange information in research and study.

In short, the productivity paradox does not appear for the case of total development investments and the share of R&D investment for Vietnamese enterprise. However, these effects are slightly weaker than those of IT facilities are. Besides these factors, total assets per employee and labor quality are important determinants of productivity.

4.3. Comparative analysis for different sectors

Because scale economies affect the manufacturing and commercial-service sectors differently, the mean efficient size of commercial-service firms is different from manufacturing ones (Teruel-Carrizosa, 2008). Due to their distinction, the study replicates the empirical study for these sectors separately, see Table III.6. Model (1) presents the effect of IT facilities on productivity in the manufacturing sector. Model (2) illustrates the effect of development investments on productivity in the manufacturing sector. Model (3) examines the effect of IT facilities on productivity in

[49] *This relationship is moderated by different economic contexts.*

the commercial-service sector. The final model investigates the effect of development investments on productivity in the commercial-service sector.

Table III.6: Effects of IT Facilities and Development Investments in Different Sectors

Dep. Var.: Labor Productivity	Manufacture-IT	Manufacture-Dev. Inv	Commercial -IT	Commercial - Dev. Inv
Exp. Vars.	**(1)**	**(2)**	**(3)**	**(4)**
IT facilities				
Computer per capita (Com)	2.1683***		0.5998	
	(0.683)		(0.478)	
LAN connection	0.0174		0.1100***	
	(0.021)		(0.042)	
Internet situation	0.0061		0.1060**	
	(0.024)		(0.046)	
Firm attributes				
Capital intensity	0.1383***	0.1230***	0.1814***	0.0792**
	(0.022)	(0.023)	(0.034)	(0.037)
Labor quality	0.4728***	0.4970***	0.3103***	0.3098***
	(0.018)	(0.020)	(0.034)	(0.033)
Firm size 1 [x]	0.1824***	0.1598***	0.3897***	0.4817***
	(0.029)	(0.028)	(0.046)	(0.047)
Firm size 2 [xx]	-0.1756***	-0.1739***	-0.4570***	-0.4586***
	(0.021)	(0.021)	(0.035)	(0.034)
Leverage	0.1534***	0.1566***	0.6549***	0.6754***
	(0.036)	(0.036)	(0.078)	(0.077)
Globalization factors				
Market size	4.2419***	3.6025***	-1.6556***	-1.2184***
	(0.471)	(0.534)	(0.384)	(0.390)
Trade growth	-1.7982***	-1.4969***	1.0495***	0.7905***
	(0.216)	(0.243)	(0.222)	(0.228)
IT & moderating effects				
Com*LAN	-0.2302		-0.2902**	
	(0.201)		(0.147)	
Com*Internet	0.1687		-0.3572	
	(0.290)		(0.293)	
Com* Capital_intensity	-0.3951*		-0.2720***	
	(0.219)		(0.101)	
Com*Labor_quality	-0.5269***		-0.0248	
	(0.146)		(0.098)	
Com*Firm_size_1	-0.2348		0.0698	
	(0.239)		(0.140)	
Com*Firm_size_2	0.2819**		0.1161	
	(0.110)		(0.099)	
Development investments				
Total Development investments		0.0041		-0.0069
		(0.005)		(0.007)
R&D investment rate (RD)		0.2930***		0.4818***
		(0.070)		(0.118)
Equipment investment rate		-0.0042		-0.0051
		(0.026)		(0.057)
Construction investment rate		0.0000		-0.0101
		(0.029)		(0.053)
RD & moderating effects				
RD*LAN		0.0215		0.1064***

		(0.019)		(0.033)
RD*Internet		0.0047		0.0513
		(0.021)		(0.036)
RD*Capital_intensity		-0.0261		0.0351
		(0.028)		(0.038)
RD*Labor_quality		-0.1014***		-0.0297
		(0.020)		(0.033)
RD*Firm_size_1		0.0787***		0.0122
		(0.029)		(0.041)
RD*Firm_size_2		-0.0240**		-0.0713***
		(0.010)		(0.019)
Constant	-34.5909***	-28.7762***	22.1027***	18.1462***
	(4.220)	(4.791)	(3.649)	(3.698)
R^2	0.271	0.272	0.305	0.312
Observations	6592	6592	2077	2077

Note: Standard errors are in parentheses. (*), (**), and (***) denote statistical significance at least at the 10%, 5%, and 1% levels, respectively. (^{x}), (^{xx}) denote Total assets per employee, Total fixed assets & long-term investment, respectively. Model (1) presents the effect of IT facilities on productivity in the manufacturing sector. Model (2) presents the effect of development investments on productivity in the manufacturing sector. Model (3) presents the effect of IT facilities on productivity in commercial-service sector. Model (4) presents the effect of development investments on productivity in commercial-service sector. Final model presents the effect of development investments on productivity in commercial-service sector.

In general, the empirical results show the distinction between two sectors, the manufacturing and the commercial-service firms. Regarding IT facilities, computer per employee extremely contributes to productivity for the manufacturing but not for the commercial-service firms in models (1, 3). The reversed situation happens for LAN connection and Internet situation; they are insignificant for the manufacturing but significant and positive for the commercial-service firms. With respects to development investments, the results are the same for both sectors. Only R&D investment rate has positive and significant effect on productivity, other portfolios have insignificant effects. Therefore the *first hypothesis*[50] depends on types of IT facilities/development investments, and factors.

Two sectors are distinct in terms of moderating effects. Labor quality, and fixed assets and long-term investments have significant moderating effects on the relationship between IT facilities and productivity for the manufacturing but not for the commercial-service firms. Total assets and labor quality have significant moderating effects on the relationship between development investments and productivity for the manufacturing but not for the commercial-service firms. Thus, the *fifth hypothesis* seems reasonable for the case of IT facilities but not for the case of development investments.

[50] IT facilities, development investment have positive effects on firm productivity.

5. Conclusions

The “productivity paradox” presents the contradiction that increase in firm IT investments has not been combined with increase in its productivity (Brynjolfsson, 1993). This essay responds to growing calls for further research on the assessment of this “productivity paradox” and how organizational context moderates this “paradox” (Orlikowski and Iacono, 2002; Kobelsky et al., 2008). This study contributes to the understanding of the relationship between IT facilities/development investments and firm productivity.

In short, for the case of Vietnamese enterprises, the “productivity paradox” does not occur for R&D investments of all firms, for computerization for the manufacturing firms, for LAN connection and Internet situation for the commercial-service firms. Therefore, the implication for managers who aim at increasing labor productivity is that an increase in R&D investment rate seems appropriate. Besides, managers in the manufacturing sector should consider enhancing computerization, while managers in the commercial-service sector should pay attention to apply LAN and internet connection. Besides, for business management, our findings suggest about the mechanism of contextual moderators by which IT facilities/development investments contribute more benefit to productivity. This suggestion is useful to improve managerial skill. In the details, to moderate computerization effect on labor productivity in manufacturing firms, more fixed assets and long-term investment may be necessary. In addition, to enhance the effect of R&D investment on labor productivity, increasing total assets per capita could be useful.

There are some limitations of this study. Due to the limitation of the data, the employed IT measurements are only based on the number of computers not the IT expenditure, thus it does not account for the difference of computer’s technology levels which could be estimated by its expenditure. Therefore, the high technology computer is equal to the normal one in the valuation. Besides, because of the limitation of the data, the study is able to measure only labor productivity, which only investigates one of three main factors of production, labor, while total factor productivity (TFP) covers all these factors. Moreover, due to the limited data, this essay could not examine the effect of IT personnel which is an important measure of IT nowadays. Besides, further investigation of contextual moderating factors relative to outside external factors should be considered.

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IV. SURVIVAL OF NEW STATE-OWNED AND PRIVATE ENTERPRISES IN A TRANSITION ECONOMY

ABSTRACT

This essay focuses on determinants of survival of new state-owned and private firms in the manufacturing sector in a transition economy, Vietnam,during the period 2000-2007. The semi-parametric Cox proportional hazard model is applied with a comprehensive specification of firm-specific, industrial and macroeconomic factors. There is evidence supporting the thesis of a 'liability of adolescence'. Findings imply that the negative effect of state-ownership fades under other effects or economic contexts. After controlling the effect of start-up total assets, private-ownership seems to benefit firm survival. There is strong evidence of market selection that labour productivity is the most important internal factor supporting firm survival. Other evidence is that firms with higher profitability in terms of profit per employee will have higher survival probability. There are differences between state-owned and private firms in terms of determinants of survival. Market share and small size are considered an obstacle only for SOEs firm survival. However, equitization reduces the risk of SOEs mortality. For private firms, in terms of start-up factors, although total assets increase probability of survival, total sales decrease. Besides, industries which have increasing number of employees open favourable opportunities only for new private firms. While the macroeconomic factor, GDP, significantly supports the development of private firms, the northern location is an advantage to the survival of SOEs.

Keywords: firm survival, determinants, new firms, state-owned enterprises, private firms, manufacturing sector, transition economy, Cox proportional hazard model.

1. Introduction

New firms have an important role in creating jobs, bringing new products, encouraging technical innovation, and pushing economic growth and competitiveness. They can entry into markets easily, however, most find harsh to survive and this survival difficulty is considered a 'stylised fact' of survival empirical analysis (Geroski, 1995). Therefore, firm survival determinants are key elements to understand the selection dynamics of market competition (Esteve-Pe´rez, S. and Man˜ez-Castillejo, 2008).

Numerous empirical studies provide various internal factors that affect survival of new firms. The firm's attributes lead to different strategic choices, to different capacities to confront with economic shocks, and as the results, to different outcomes and survival prospects (Esteve-Pe´rez, S. and Man˜ez-Castillejo, 2008). An internal factor considered by numerous researchers is ownership. Some investigate the difference between domestic and foreign-owned firms but effects of these ownerships on the hazard rate are inconsistent (Mata and Portugal, 2002; Kimura and Fujii, 2003; Go¨rg and Strobl, 2003; Esteve et al., 2004; and Esteve and Man˜ez, 2008).

Whereas most empirical studies analyse firm survival in developed countries, there is a gap of research for developing countries. Hansen et al. (2009) analysed whether

government support influenced the long-run performance of manufacturing SMEs in Vietnam during the period 1990–2000. They found that enterprises which had their main customers in the state sector had higher survival prospects. However, they employed Probit and OLS methods that could not account for distinct characters of survival analysis[51].

Whereas developing countries are typical with the significant presence of state-owned enterprises (SOEs) and transition economies are typical with the promotion of the private sector, no research has hitherto provided an analysis for comparison between state and private ownerships, thus the recent study attempts to bridge this gap. Vietnam offers an appropriate laboratory among developing countries to investigate determinants of firm survival. In 1986, Vietnam conducted a transition from the centrally planned economy, including only SOEs and co-operatives, to the market oriented economy, with multi-sectors. One of the reasons compelling the government to conduct this economic reform is the inefficiency of its central planned system leading to the failure of many SOEs (Pham and Mohnen, 2005). An economic solution for this issue was promoting private firms and demising inefficient SOEs by the *equitization*[52] of SOEs implemented from 1992. Consequently, over 12 years of *equitization*, the total number of completely equitized SOEs is up to 2,242 with their total capital of around VND 17,700 billion (Loc et al., 2006). Furthermore, the private sector contributes the number of jobs three folds higher than that contributed by SOEs (Liu, 2004). In addition, Vietnam has experienced tremendous changes in economic structure that have enhanced the growth of enterprises (Baughn et al., 2004), especially opened new prospects to enterprises when joining the WTO in 2006. However, private enterprises find it difficult to grow (Tran et al., 2008), and the high failure rate of new private firms indicates their considerable difficulties during market penetration[53].

Therefore, this essay concentrates on the dynamics of the development of new SOEs and private firms in a transition economy, and investigates main determinants of their survival during 2000-2007, a period of strong globalization in Vietnam. Since most

[51] OLS or a binary dependent regression model (e.g. logit, probit) cannot handle three aspects of survival time data very well: i) censoring (and truncation) ii) time-varying covariates; iii) structural.modelling (Jenkins, 2005; pp. 8-10).
[52] Equitization is similar to privatization in terms of swifting SOEs to joint-stock companies with participation of private investers to increase efficiency of state sectors. The difference between two concepts is that equitization allows state participation to keep its ultimate decision-making power (Loc et al., 2006).
[53] http://www.vnep.org.vn/en-US/Development-of-Enterprises/Backing-beyond-basics.html

empirical studies investigate firms in the manufacturing sector, this study analyses new firms in this sector to facilitate comparison. The essay presents several contributions. The investigation is emphasized by a comprehensive specification of firm-specific, industrial and macroeconomic factors. With respect to methodology, the essay employs both nonparametric and parametric methods in survival analysis to understand fully the patterns of firm survival. Moreover, tests for proportional hazard assumption and unobserved heterogeneity that have been so far neglected in numerous studies are addressed in this study. The control of unobserved heterogeneity will help to provide unbiased estimates of both explanatory variables and duration dependence coefficients. (Esteve-Pe´rez, S. and Man˜ez-Castillejo, 2008). The semi-parametric Cox proportional hazard model is applied, accounting for the "ties" which typically occur in empirical studies whenever annual data are employed (Cox and Oakes 1984). Moreover, the data cover multi-size, which will help to bridge the gap in recent research that most focus on large firms. Besides, the data cover the years from 2000 to 2007, an episode of strong globalization processes in Vietnam.

The rest of the essay is organized as follows. Section 2 is devoted to an overview of the literature and research hypotheses. The next section briefly describes the employed methodology including model, variables, and data. Section 4 focuses on non-parametric analysis. Section 5 presents the empirical results and analysis. The final section concludes and points out some policy implications.

2. Literature review and research hypotheses

A rich body of literature has found out some main determinants of firm survival, including internal factors relative to firm attributes, and external factors relevant to the environment where the firm engages.

In the light of the resource-based view, internal factors seem inimitable for competitors and thus become their specific competitive advantage (Geroski et al., 2010). Therefore, firm attributes are considered important determinants of firm survival (Wernerfelt, 1984; Barney, 1991, Burgelman, 1994; and Chang, 1996). An internal factor considered by numerous researchers is ownership (Mata and Portugal, 2002; Kimura and Fujii, 2003; Go¨rg and Strobl, 2003; Esteve et al., 2004; and Esteve and Man˜ez, 2008). In developing economy, state ownership has a significant presence and receives

a priority in government support. This ownership even has a positive effect on the survival of its suppliers (Hansen et al., 2009).

Hypothesis 1: SOEs have higher probability of survival than private enterprises.

Furthermore, this essay contributes to the literature on firm survival with investigation of firm sustainability. It expresses the endurance and flexibility of firms when dealing with obstacles. Some of its proxies are productivity and financial factors. The maintenance of high productivity will support firm survival (Carreira and Teixeira, 2009). In addition, financial variables are considered important conditions of firm survival (Saridakis et al., 2008). For instance, leverage represents firm liquidity that is one of the most important tools to deal with insolvency. Firms with smaller amount of debt will have higher opportunity to survive (Fotopoulos and Louri (2000a). Musso and Schiavo (2008) provided evidence that financial constraints threatened firms with high risk of death. Similarly, Demirguc-Kunt and Maksimovic (1998), and Beck et al. (2005) explained that financial development improved firm capacity to deal with impediment to grow faster.

Hypothesis 2: Firm survival depends positively on sustainability.

Besides, the power of market selection with a severe disciplinary effect will drive inefficient enterprises out of the market (Mata and Portugal, 2002). Numerous empirical studies have investigated measures of profitability in analysis of firm survival and most have consistently found that firms that are more efficient would have longer life (Siegfried and Evans, 1994; Kleijweg and Lever, 1996; Bernard and Jensen, 2002; Harris and Li, 2010).

Hypothesis 3: Firm survival depends positively on profitability.

In addition, most empirical research has investigated the effect of firm size; however, the results are inconsistent. Some found that there was no evidence of size effect on new firm survival (Audretsch and Mahmood 1991, 1994). However, others confirmed that the size effect on firm survival was non-linear (Mata and Portugal, 1994; Esteve et al., 2004; and Strotmann, 2008). According to industrial organisation theories, small firms have to cope with higher restrictions on capital markets, higher disadvantages of

scale, and are less attractive to highly qualified labour force as well as talents of management (Lucas; 1978; Strotmann, 2008). Consequently, they face a higher risk of bankruptcy, leading to a higher hazard of mortality.

Hypothesis 4: Large firm size reduces hazard rate of failure.

Besides, the concept 'liability of smallness' emerges from findings that the risk of firm failure is negatively relative to its start-up size (Audretsch and Mahmood, 1995; Agarwal and Audretsch, 2001; Mata and Portugal, 1994; Segarra and Callejon, 2002). Similarly, start-up factors, especially those relate to firm size, are consistently considered important determinants of firm life span (Dunne & Hughes, 1994; Segarra & Callejon, 2002; Jensen et al., 2008).

Hypothesis 5: Hazard rate of closure depends on firm start-up factors.

Additionally, environmental conditions have been acknowledged as significantly important external factors to firm survival; that is, the specific conditions of the environment in which firms are established and grow will lead them to different prospects and performance, however, few empirical studies have paid attention to these conditions (Box, 2008). Industrial and macroeconomic environments imprint and influence the behaviors and reactions of firms, thus, there is an interaction between internal/micro and external/macro factors (Baumol 1990; Davidsson 2004; Box, 2008).

Hypothesis 6: There are interaction effects among internal and external factors on firm survival.

With respect to external factors, the structure of a specific market in which firms engage will affect their performance. Growing industries verse mature ones give opposite effects on firm survival. Numerous empirical studies have found that industry growth increases probability of firm survival (Audretsch and Mahmood, 1994, 1995; Mata and Portugal, 1994; Tvetera°s and Eide, 2000; Segarra and Callejo´n, 2002; Mahmood, 2000; Go¨rg and Strobl, 2003; and Lo´pez-Garcı´a and Puente, 2007). A growing industry with an increasing number of firms and employees imposes a direct competitive pressure not only on incumbents but also on entrants; therefore, it affects firm survival (Jensen et al., 2008). When the number of incumbents in an industry is

relative small, this environment gives firms various opportunities to entry and develop (Geroski et al., 2010). Moreover, the hazard rate of firm failure decreases when firms extend their size in growing industries (Audretsch, 1995; Segarra and Callejo´n, 2002; and Cefis and Marsili, 2005). However, industry concentration supports the survival prospects only during the first years, thus, after a certain threshold, more entrants lead to serious competition, and then market selection leads to high mortality, or firms face high hazard rate in the mature industries (Hannan and Carrol, 1992).

Hypothesis 7: Hazard rate of new firm failure depends negatively on competitiveness and concentration of industry.

In addition, a favourable regional agglomeration with the availability of qualified workers, comfortable transport, broad markets, and the like, will be an advantage to firm survival and development. However, the effect of an agglomerated region is still ambiguous (Strotmann, 2008). Keeble and Walker (1994) concluded that population density, as the proxy of agglomeration, hampered new firms to survive. Besides, macroeconomic environments imprint and influence firm behaviors, as the result, affect its survival (Davidsson 2004; Box, 2008). Fertala (2008) gave evidence that failure probability depended positively on the local economic development. The reason may be that the current economic conditions will change firm expectations about the future (Geroski et al., 2010).

Hypothesis 8: Unfavorable current macroeconomic conditions increase the hazard rate of firm failure.

Regarding survival models, in general, the most commonly used model is the Cox Proportional Hazard. The most consistent effects on firm failure are age, size, technology, R&D, economies of scale, entry rates and growth, and industry life cycle while the impacts of price-cost margin, capital intensity, and market concentration seem inconclusive (Manjo´n-Antolı´n and Arauzo-Carod, 2008). Focusing on investigating determinants of firm survival, research with the most important contributions conducted in the last two decades is summarized in the below Table IV.1[54].

[54] See Box (2008, pp. 391), and (Manjo´n-Antolı´n and Arauzo-Carod, 2008, pp. 3-10) for more literature review.

Table IV.1: Empirical Studies of Firm Survival

Reference	Models	Tests	Sample	Discrete/ con. time data	Main variables	Findings
Audretsch and Mahmood (1991)	Cox	No	7,070 manufacturing establishments created in 1976, during 1976–1986.	Continuous	Start-up size, minimum efficient scale, industry-market growth, total innovation rate, small-firm innovation rate, total innovation rate, industry innovation rate.	Determinants increasing probability of survival for new establishments in U.S. manufacturing are large start-up size and operating in industries where economies of scale have an important role. These effects depend on both the firm ownership structure and the technological environment.
Mata and Portugal (1994)	Cox model-Piece-wise constant hazard	Het.	3,169 manufacturing enterprises founded in 1983, during 1983–1987.	Discrete	Number of plants, start-up size, minimum efficient scale, industry growth, total employment of firms in each industry, industry growth, number of firms in the industry, herfindahl index.	Determinants increasing new firm survival are the number of subsidiaries, its start-up size, and the industry growth rate. The level of firm entry in the industry in which firm engages increases the risk of firm failure.
Audretsch and Mahmood (1995)	Cox	No	12,251 manufacturing enterprises created in 1976, during 1976–1986.	Continuous	Technological regime, start-up size disadvantage, industry-market growth. Dummies for branches and subsidiaries, macroeconomic variables: real interest rates and unemployment.	Main determinants of new firm failure are firm attributes, start-up size and the structure of ownership.
Fotopoulos and Louri (2000)	Cox	No	209 manufacturing establishments created in 1982, 1983 and 1984.	Discrete	Size; financial variables: leverage, sale-asset ratio, ratio of fix assets to total assets; firm growth, dummies for sunk costs, cohort, location.	Main determinants of firm survival are current size, leverage, profitability, capital with growth and contestability of industry. Besides, location (in Athens) is an advantage for firm to survive, especially for

						small firms.
Agarwal and Audretsch (2001)	Cox	No	3,431 establishments in 33 manufacturing industries, during 1912-1991.	Continuous	Start-up size, technological conditions, product life cycle, industry dummies.	Smaller firms have lower probability of survival. However, the comparison does not remain when firm products are at the mature stages of life cycle, or are technological intensive. The effect of firm size on the probability of survival depends on the level of technology and the phase of the life cycle in an industry.
Mata and Portugal (2002)	Piece-wise constant hazard	No	610 new foreign-owned enterprises and 539 new domestic enterprises during 1983–1990.	Discrete	Labor qualification, size, age, legal structure, growth rate. Herfindahl index (concentration), industry growth, entry rate, foreign presence, minimum efficient scale.	Firm attributes determining probability of survival includes size, growth strategies, ownership advantages, internal organization. Determinants in terms of industry characteristics are economies of scale, entry rate, and growth of industries. After controlling these factors, foreign firms are similar to domestic ones in terms of determinants of survival and identical time patterns of closure.
Disney et al. (2003)	Cox	No	3,329,635 single and 19,297 group-manufacturing enterprises during 1986–1991.	Discrete	Start-up and current size of firms or of multi-unit firms; age; total manufacturing sales of industry at the 4 digit, cohort and time dummies.	There are interactions between firm survival, size, and age. These interactions depend on firm structures, single firm, or part of a group.

Esteve et al. (2004)	Cox	PH	2,912 manufacturing establishments during 1990–1998.	Discrete	Size, age, dummies of exporting firms that have foreign capital participation, produce final goods, and are limited liability companies.	Firms facing high failure risk are small, young, and mature firms. However, exporting and investing on R&D activities extend survival prospects.
Cefis and Marsili (2005)	Cox, Weibull, Exponential, Log-normal	PH	3,275 manufacturing enterprises that are established in 1996. (larger than 10 employees) during 1996–2003	Discrete	Age, size, firm growth. Dummy variables for innovation and innovation types.	The most important positive effect of firm survival is operating in high intensity technology sectors. Other positive effects at firm level are innovation premium, growth rate, and age.
Strotmann (2008)	Cox, Generalized Gamma, Lognormal and Log-logistic.	Het.	2,605 start-ups with less than 50 employees established between 1981 and 1984.	Discrete	Start-up size, dummy for single vs. Multi-plant firms, Herfindhal index, industry growth, scale economies, number of plants in the industry (market size), entry rate, industry heterogeneity (log of the excess-job-turnover rate), dummy for high-tech industries, cohort (or year) dummies, annual growth rate of firm employment.	Larger minimum efficient scale increases the risk of firm failure because the worse demand-conditions in industry, the smaller the market. However, high start-up size is an advantage for firm survival. The relationship between age and the risk of failure is non-linear, that is, the probability of survival decreases immediately after the foundation year, down to its minimum within one or two years, then increases in a monotonic way.
Esteve-Pe´rez and Man˜ez-Castillejo (2008)	Cox, Weibull and Exponential	PH, Het.	2,028 manufacturing establishes during 1990–2000 .	Discrete	Dummies for advertising and R&D (firms' strategies), size, performance (labour productivity), exporting intensity, legal structure and foreign participation. Dummies for technological level of the	Advertising and R&D to develop firm specific assets will support firm survival. Furthermore, probability of failure increases within around 20 years, and decreases afterwards.

					industry, price cost margin and year.	
Saridakis et al. (2008)	Log logistic ; Cox PH	Het.	622 small enterprises in England during 2001- 2004 71% of these enterprises were young (less than five years old in 2001).	Continuous	size in 2001, finance variables (start-up bank/finance, company, start-up public authorities, financially constrained), strategy variables (price competition strategy, product innovator), human capital variables, founder age, degree, professional qualification, industry dummy.	The bank finance and the founder's education decrease firm hazard rate of failure. Price competing, or reporting being restrained in finance at start-up leads firms to higher failure risk.
Bridges and Guariglia (2008)	Cox PH	Robustness tests, Het.	Panel of 61,496 UK firms during the period 1997–2002	Continuous	Total assets, age, real assets, profitability, leverage, collateral, global engagement variables: export, foreign. Industry dummies.	There is evidence that global engagement protects enterprises from financial constraints; that is, higher leverage as well as lower collateral cause higher failure risk for purely domestic enterprises than for globally engaged ones.
Burke et al (2008)	Cox proportional hazard model	Wilcox Log-rank test; Wald test	6 year period, 1997–2002.	Continuous	Size, firms' sales shares, industry growth (the net sales). Foreign presence is measured by the employment share of MNCs in sector. Dummy variables for different cohorts in plant size.	FDI has net negative effects in dynamic industries and net positive effects in static industries on firm survival. The negative effect results from displacement risk, while the positive one results from knowledge spillover and linkage.

Musso and Schiavo (2008)	proportional hazards form	Het.	panel data on French manufacturing firms over the 1996–2004 period	Continuous	Firm size (total assets), profitability (return on total assets), liquidity (current asset over current liabilities), cash-flow-generating ability, solvency ability, ratio of trade credit to total assets, and repaying ability (ratio of financial debt to cash flow).	Financial constraints cause firm failure, In contrast, accessibility to external financial resources supports firms in terms of employment, sales, and capital stock, as a result, of firm survival.
Box (2008)	Cox proportional hazards model with time-varying covariates.		Nearly 2,200 firms in seven birth cohorts of Swedish joint-stock companies, between 1899 and 1950.	Discrete	GDP growth, discount rate, firm size, manufacturing industry, prewar cohort, interwar cohort, firm size • GDP growth, discount rate.	Firm survival depends on macroeconomic environment. While economic expansion encourages firm to develop, economic crisis raise high risk of failure for entrants. Furthermore, hazard rate of failure depends on firm populations due to difference of affiliation levels and environmental forces.
Shiferaw (2008)	The discrete-time hazard function	Het.	1996–2002.471 in 1996 to 686 in 2002.that employ at least 10 persons.	Discrete	Size; duration; productivity; factor intensity; ownership; industry characteristics; location	Single-unit establishments face higher failure risk than those belong to multi-unit ones. Female-owned businesses have higher opportunity to survive than male-owned ones. Firms with smaller-size and lower productivity will be easier to exit.
Jensen et al., (2009)	The piece-wise constant exponential hazard function		unbalanced panel of 261 510 companies (observed during the period 1997–2005),	Discrete	Patent applications, trademark applications, R&D expenditures, size, ownership structure, parent of subsidiaries; competitive environment (the ratio of number of new firms to the number of incumbents), innovativeness of the industry;	On one hand, new firms have high probability to survive in risky and innovative industries. On other hand, they are more vulnerable to business cycle effects.

					changes in gross domestic product; changes in gross operating surplus of industry, index of the Australian stock market.	
Hansen et al. (2009)	Probit and OLS methods	Wald test	unbalanced panel of 807 enterprises from three surveys in 1990/1991; 1995/1996; 2000/2001	Discrete	Firm size (revenue, employment), firm age, innovation (new/improved product), location, initial government assistance, state customer, owner education, gender, spin-off (previous experience)	Enterprises with their main customers that are in the state sector have lower failure risk. Temporary tax exemptions at firm start-up time support non-household firm to survive and initial credit support promotes rural firms.
Carreira and Teixeira (2009)	Cox proportional hazard model (Cox, 1972, 1975)	Wald test, Het.	1,900 manufacturing firms from the central region of Portugal during 1991–2000 (unbalanced panel).	Discrete	TFP, labour productivity, age, size, GDP growth, unemployment, industry growth, technological regime, industry size, entry rate, industry concentration, export intensity	Generally, firms experience a decreasing productivity level over few years prior to exit. Both small firms and low- productivity ones are more likely to close. Industrial and macroeconomic environments are considered reasons of the failure of mature firms.
Juste et al. (2009)	Cox proportional hazard time regression model.	PH, Wald test, Het.	188 franchise chains for from 1995 to 2003, in restoration and fashion retailing sector	Discrete	Entry time, size, centralization, experience before, franchising, diversification, GDP competition, sector dummy.	Pioneering is an advantage to firm survival. Early entry strategy benefits firms to survive. Other determinants of survival are experience and dual distribution.

Helmers and Rogers (2010)	Probit model and Kaplan and Meier estimate	No	162,000 limited companies that incorporated in Britain in 2001, study time: 2001-2005	Discrete	Capital intensity; minimum efficiency scale (MES); the industry growth rate; competitive conditions for entrants: the share of firms using patents in an industry, the share of firms using trade-marks; sector dummy variables, region dummy variables; house prices and unemployment; firm size; foreign ownership, subsidiary, location	Firms more intensive in intellectual property (IP) will have lower probability of failure. There is a considerable distinction in probabilities of survival across sectors. In general, trademarking supports firms to survive while patenting only benefits firms in some specific sectors.
Harris and Li (2010)	Semi-parametric model; Weibull distribution,	No	An unbalanced panel, containing 91,701 firms operating in all-market-based sectors with 247,028 observations during 1997–2003.	Discrete	Age of firm; foreign-owned; non-zero intangible assets; start-up employment; growth in industry; displace rate (employment of new entrants/employment of existing firms in time); TFP; capital intensive (tangible assets-to-labour ratio); current employment; industry (two-digit) Herfindahl index; import penetration	Firms which have experienced export-market entry and exit have higher life prospects. After controlling other attributes relative to productivity, factors promoting the firm's survival prospects are capital intensity, young age, TFP, foreign ownership, displacement effects, and operating in some specific industries. Increased import penetration benefits continuous exporters and exporting entrants, while harms domestic firms or those quit exporting.
Geroski (2010)	Semiparametric discrete proportional hazard model	Het.	sample during 1982 - 1995, more than 100,000 firms in each year	Discrete	Firm size (revenue, employment), firm age, innovation (new/improved product), location, initial government assistance, state customer, owner education, gender, spin-off (previous experience). Exit rate in an industry, region dummies.	Start-up factors are considered important determinants of firm survival. Their effects remain with little lessening for several years afterwards.

Wennberg and Lindqvist (2010)	Piecewise exponential hazard model, time-series regression based on generalized least squares.	Wald test. Wooldridge test	4,397 Swedish firms, during 1993-2002, started in , medical equipment, financial services, information technology, the telecom and consumer electronics, and pharmaceuticals -pharmaceutical sectors	Discrete	Failure. Job creation, vat payments, salary payments, legal form (incorporation), population density. House price index, region employment, local universities, employees, human capital special human capital, cluster employment, inverse mills ratio; dummy variables for age, and cluster sectors.	Clusters influence positively firm survival. The effect persists for measures of absolute agglomeration, but fades for measures of relative agglomeration.

Note: het.: Unobserved heteroscedasticity; PH: Proportional hazard.; con.: Continuous

3. Methodology

The purpose of the present study is to evaluate determinants of firm failure. "Firm failure" or exit or death refers to disappearance of firms from the market, while survivors are firms that continue to appear[55]. "Firm failure" function is considered the function of probability that a firm which is characterised by a set of features X fails at time t given that it was 'alive' until t[56].

There are some specific concepts in survival analysis. For instance, 'right censoring'[57] means that after the end of study time, firm failure or how long firm survival cannot be observed or known. Besides, the *hazard rate* of firm failure, represents the instantaneous rate at which firm i exits at time t with condition that the firm is survival up to time t[58]. The baseline hazard rate is the hazard rate when all covariates are zero[59]. "Hazard function"[60] is created to measure the probability of an event, like firm failure, occurring within an instant interval of time after t. In addition, in survival analysis, the studied variable is the spell from the establishment of a firm to the end of its operation, or the time elapsed between entrance and closure[61]. In principle, there is not sufficient theory to identify the shape of the baseline hazard, as a result, most studies have to make a specific assumption, thus, survival analysis requires a statistical model which is capable of controlling such characteristics[62].

Most of all, there is one method satisfying above issues, namely semi-parametric Cox proportional hazard (CPH) model which is proposed by Cox (1972). In general, this method indeed becomes the most widely applied estimation method in analysis of firm survival (Manjo´n-Antolı´n and Arauzo-Carod, 2008; Carreira and Teixeira, 2009). Similar to other survival models, this method handles well three aspects of survival time data which other approaches cannot: i) censoring (and truncation); ii) time-varying covariates; iii) structural modeling[63]. However, more advantaged than others, this method leaves the baseline hazard non-parameterised, that is, it does not require an

[55] Manjo´n-Antolı´n and Arauzo-Carod, 2008, pp. 11.
[56] Manjo´n-Antolı´n and Arauzo-Carod, 2008, pp. 11; Stevenson, 2009, pp. 3.
[57] Jenkins, S. P. (2005), pp. 4.
[58] Manjo´n-Antolı´n and Arauzo-Carod, 2008, pp. 11.
[59] Stevenson, 2009, pp. 16.
[60] The stochastic events of the interested variable can be described completely by hazard function (Manjo´n-Antolı´n and Arauzo-Carod, 2008).
[61] This spell is complete if the period of time is fully observed, otherwise is right and/or left censoring (namely, incomplete spell)(Manjo´n-Antolı´n and Arauzo-Carod, 2008).
[62] http://psweb.sbs.ohio-state.edu/faculty/jbox/Courses/ps786eh/statanotes.pdf.
[63] Jenkins, S. P. (2005, pp. 8)

assumption about the baseline hazard shape over time (Blossfeld & Rohwer, 1995; Harris and Li, 2010).

Besides, similar to most previous empirical studies, the employed dataset is abstracted from annual censuses; thus this study cannot observe firm entrance or closure at an exact time (hour, day, week, or month). In other words, the study time is grouped into yearly intervals, or the dataset is discrete time data[64], thus for this case CPH model is mostly appropriate (Wennerberg, 2010).

Therefore, this study employs the CPH model measured with the STATA (Version 10.0) software package to examine the effect of various internal and external potential determinants on the hazard rate, with different types of censoring.

3.1. Research model

In this model, λ_i (t), the hazard rate of firm failure, represents the instantaneous rate at which firm i exits at time t with condition that the firm is survival up to time t. The hazard function λ_i (t; X_{it}) is given by:

$\lambda_i(t; X_{it})$= P[firm i at t| survival to t; X(it)]=P[T=t| T≥t, X(it)] (IV-1)

In addition, the CPH model has the form:

$$\lambda_i(t) = \lambda_0(t)\exp(X_{it}\beta) \quad \text{(IV-2)}$$

In function (IV-2), λ_0(t) is the nonparametric base-line hazard. This semi-parametric model is more advantaged than other alternative specifications due to leaving functional form nonparametric, which helps to avoid misspecification function of the baseline hazard[65]. exp ($X_{it}\beta$) is a parameterised function of explanatory variables. X_{it} is a matrix of internal and external factors assumed to affect the hazard rate. This study investigates both time-invariant and time-varying factors. β is a matrix of coefficients of internal and external factors. Firm age (years) is the unit of time analysis. In this study, new firms are defined as ones born in 2000, which will be observed during the period 2000-2007.

[64] In duration analysis, most of economic variables are collected as discrete data (quarterly, annually data). Thus it is common characteristics of available survival data. (Manjo´n-Antolı´n and Arauzo-Carod, 2008).
[65] See Blossfeld & Rohwer (1995) and Harris and Li (2010)

In econometrics, there is the pervasive existence of unobserved individual heterogeneity[66]. In general, unobserved heterogeneity may result in biased estimates and overestimates. Thus, to have valid empirical results, this issue needs controlling in firm survival models. For the case with unobserved individual heterogeneity, the CPH model can be generalized as follows:

$$\lambda_i(t) = \lambda_0(t)\exp(X_{it}\beta) * v_i = \lambda_0(t)\exp(X_{it}\beta + u_i) \quad \text{(IV-3)}$$

where v_i represents an unobserved individual heterogeneity. v_i is also assumed to follow a gamma distribution with unit mean and finite variance σ^2. For empirical results, the null hypothesis of no unobserved heterogeneity will be tested.

For the case of discrete time or annual data, there are 'ties'[67] in grouped-form data. To handle these 'ties', similar to most of empirical studies, the study applies Efron's (1977) approximation method. To test the proportional hazard assumption, the Schoenfeld test is employed for each individual factor and for the full set of covariates. The Wald test examines the null hypothesis that all parameters are zero. The hypothesis of no unobserved heterogeneity is tested with the option of shared frailty. Function (IV-3) will be estimated stepwise with groups of main potential determinants of firm failure for the whole sample and each sector to compare with each other.

3.2. Variables

In the present survival study, firm exit or failure or death refers to disappearance of firms from the data by the end of analysed period (2007), while survivors are firms that continue to appear at the end of the analysed period[68].

The dependent variable, hazard rate, is the probability of a firm which is characterised by factors X, exiting its market at year t given that it was 'alive' until year t[69]. Study time is firm age in years. Regarding independent variables, they are theoretically driven, see Table IV.2.

[66] Firms have some important but unobserved factors, such as management quality, fame, prestige (Manjo´n-Antolı´n and Arauzo-Carod, 2008).
[67] Survival times are grouped at the reporting stage, Cox and Oakes (1984).
[68] Manjo´n-Antolı´n and Arauzo-Carod, 2008, pp. 11.
[69] Jenkins, S. P. (2005, pp. 10)

Table IV.2: Variables

Variable name	Explanations
Independent variable	
The hazard rate	The instantaneous rate that a firm which is characterised by a set of factors X, exits its market at year t given that it was 'alive' year t[70].
Internal factors	
Ownership	
State ownership	is equal to 1 if firm is SOE, and 0 if firm is private-owned
Joint-Stock	is equal to 1 if firm is Joint stock with 50% and more of state equity, and 0 otherwise
Sustainability	
Labour productivity	Labour productivity is measured by total sales divided by number of employees.
Leverage	The book values of total liabilities divided total assets
Profitability	
Sale-Asset ratio	The ratio of book values of total sales to total assets
ROC	Net income divided by its total capital.
ROE	Net income divided by its total owner equity.
Profit/employee	The ratio of book values of profit before tax to total assets
Start-up factors	
Start-up Leverage	The book values of total liabilities divided total assets at year of foundation
Start-up total Assets	Book values of total assets at year of foundation
Start-up total Sales	Book values of total sales at year of foundation
Firm size	Dummy variables
Small	is equal to 1 if total number of employees is fewer than or equal 50, and 0 otherwise
Medium	is equal to 1 if total number of employees is from 51-150, and 0 otherwise
Large	is equal to 1 if total number of employees is from 151-300, and 0 otherwise
External factors	
At industrial level	
Market share	Share of firm total sales per industry total sale
Market size*	Number of employees in each 3-digit industry
Market size**	Number of enterprises in each 3-digit industry
At national level	
GDP	GDP at real prices (compared with 2000)
Geographical location	is equal to 1 if firm locates in the North of country, and 0 otherwise

[70] Jenkins, S. P. (2005, pp. 10)

In terms of firm's attributes, this study employs some crucial internal factors on which a firm depends for survival. In this study, the concept of "SOEs" covers both one hundred percent state-owned enterprises and joint-stock companies with state equity because these joint-stock companies are offspring of equitized SOEs enterprises during equitization in Vietnam. Thus, this study uses dummies of ownerships to distinguish among 100% SOEs, joint-stock companies with state equity, and private ones to test the *hypothesis 1*. In order to test *hypothesis 2*, this study investigates effects of two proxies of firm sustainability, including labour productivity and leverage. Labour productivity is an important determinant of firm survival; the maintenance of low firm productivity could predict high failure risk (Carreira and Teixeira, 2009). The productivity is measured by total sales per employee. Compared with multifactor productivity, this measure is more advantaged in terms of comparability, that is, it scales the outputs of firms in all industries to the comparable one (Triplett, 1999), and it is more sensitive to any change of human capital. For this reason, many survival studies have employed this definition (Esteve-Pe´rez and Man˜ez-Castillejo, 2007; Shiferaw, 2008; Carreira and Teixeira, 2009). Besides, the increasing competition under the process of trade liberalization may cause a financial risk which lead to adjustment of financial structure. Leverage, as another proxy for firm sustainability, is defined as the ratio of total liabilities to total assets. Similar to numerous empirical studies, firm profitability is expressed by ROC, ROE, Sale-Asset ratio, and profit per employee to test the *hypothesis 3*.

Similar to various survival studies, this study investigates the effect of firm size on survival to test *hypothesis 4.* Firm size is measured by the number of employees due to the advantage that employment is not influenced or adjusted by changes of inflation like other financial measures and it facilitates comparison across studies. In addition, to examine *hypothesis 5,* this essay controls start-up factors, including leverage, total assets and total sales, since these factors have consistently considered important determinants of survival (Dunne and Hughes, 1994; Segarra and Callejon, 2002; Jensen et al., 2008).

With respect to external factors, this essay investigates some main industrial and macroeconomic factors to test *hypotheses 7 and 8*. Industrial factors, such as market sizes and market share, are important because changes in industry-level conditions

could change firm expectations and require rational responses to survive (Carpenter and Petersen, 2002). Market sizes are expressed in terms of total number of firms and total employees in each industry, representing competitiveness level and industry concentration, respectively. Market share, measured by the share of firm's total sales per industry total sales, represents firm position in the market.

In terms of macroeconomic factors, this essay focuses on GDP and firm geographical location. While GDP represents the level of national economic development, different geographical locations with different conditions of transportation, input resource, cooperators, and customers will cause different levels of convenience to firm operation.

All financial variables are deflated by the annual consumer price index (CPI). Variables including labour productivity, total assets, total sales, and market size are expressed *in logarithm* form.

3.3. Data

The data employed in the present study is abstracted from the annual survey of enterprises in Vietnam from 2000 to 2007, which is conducted by Vietnam Government Statistics Organization. It surveys all enterprises in all sectors of the national economy. However, the present study only focuses on the new SOEs and private enterprises in the manufacturing sectors, see Table IV.3, Table IV.4. The concept of "SOEs" covers both one hundred percent state-owned enterprises and joint-stock companies with state equity because these joint-stock companies are offspring of equitized SOEs enterprises during equitization in Vietnam. The concept of 'new' firms, or 'new' SOEs and private enterprises in the manufacturing sector, refers to those were born in 2000. This analysis does not account for firms born before and after year 2000.

The information of the firm's ID in the data is based to identify the status, survival, or closure, of each individual firm across census years, and to build an unbalanced-panel dataset. The information of foundation year available in the data gives firms' birth years to identify which born in year 2000. Similar to Mata and Portugal (1994) and George et al. (2008), a firm is defined to exit when it disappears in two consecutive years and before the end of analysed period (2007) and a survival firm is one that continues to operate until the end of the studied period (2007).

Similar to most other empirical studies, the employed dataset is right censored, meaning that the survival observations cannot be observed after the end of the period of study time, 2007. Our applied estimation methodology accounts for this right censoring. Although the employed dataset provides comprehensive information of employees, financial variables, and multi-cohort size, its limitations is the lack of reasons of firm exit. Consequently, the study cannot distinguish between firms exit as a result of bankruptcy or a merger. However, this fact will not bias the estimates (Jensen et al., 2009).

Table IV.3: Descriptive Statistics of the Whole Sample

Description	Mean	Std. Dev.	Minimum	Maximum
State	0.33	0.47	0	1
Cooperation	0.03	0.18	0	1
Labour productivity (millions VND)	224.50	545.62	0.13	7,992.38
Leverage	0.35	0.34	0	0.99
Sale-Asset ratio	2.29	19.72	0.00	101.98
ROC	-0.03	1.9	-45.13	5.12
ROE	0.13	2.25	-9.44	57.73
Profit per employee	3.83	24.90	-300.00	203.83
North	0.18	0.38	0	1
Market share	0.01	0.03	0.00	0.56
Market size *	2,212,803.00	623,677.20	66,315.00	3,199,526.00
Market size **	1,836.12	989.74	22.00	7,924.00
GDP	7.43	0.63	6.79	8.46
Start-up Leverage	0.31	0.32	0.00	0.98
Start-up total Assets (millions VND)	15,417.60	53,575.99	29.00	584,280.00
Start-up total Sales (millions VND)	21,621.28	85,220.79	0.00	1,216,763.00
Small Firm size	0.59	0.49	0	1
Medium Firm size	0.15	0.36	0	1
Large Firm size	0.09	0.29	0	1

Note: *: total number of employees in 3-digit industry
**: total number of firms in 3-digit industry

To facilitate comparison between SOEs and private enterprises, as well as to have robust estimates (Mata and Portugal, 2002), both analysed ownerships are in the same industry, namely the manufacturing sector. Firms that switch to other ownerships or sectors during the period from 2001 to 2007 are removed. Besides, observations with missing values for the employed variables are excluded. Finally, the used dataset is an unbalanced panel data with 2,530 observations of 544 firms, including 162 SOEs and 382 private enterprises, with descriptive statistics in Table IV.3, Table IV.4.

Table IV.4: Descriptive Statistics of Different Ownerships

Description	Mean	Std. Dev.	Min.	Max.	Mean	Std. Dev.	Min.	Max.
	Private enterprises				SOEs			
Labour productivity	218.88	620.39	0.35	7,992.38	238.87	356.43	0.13	3,059.92
Leverage	0.21	0.23	0	0.89	0.66	0.24	0	0.99
Sale-Asset ratio	2.97	22.15	0	101.98	1.47	1.74	0	27.08
ROC	-0.03	1.96	-45.13	5.12	-0.02	0.15	-1.66	0.87
ROE	0.07	0.41	-2.98	10.40	0.23	3.24	-9.44	57.73
Profit/employee	2.77	25.82	-300.00	203.83	6.09	22.80	-137.25	194.34
North	0.09	0.28	0	1	0.37	0.48	0	1
Market share	0.00	0.01	0	0.14	0.02	0.06	0.00	0.56
Leverage^{+}	0.16	0.22	0	0.89	0.61	0.27	0.05	0.98
Total Assets^{+}	1,399.75	3,285.04	29.00	47,517.50	43,995.45	86,618.96	237.50	584,280.00
Total Sales^{+}	3,221.38	7,818.76	2.00	91,237.00	59,299.04	141,141.40	324.00	1,216,763.00
Small size	0.86	0.35	0	1	0.05	0.22	0	1
Medium size	0.08	0.28	0	1	0.28	0.45	0	1
Large size	0.03	0.16	0	1	0.22	0.42	0	1

Note: $^{+}$: Start-up values

4. Non-parametric analysis

Before focusing on analysis of empirical results, non-parametric analysis will provide the overview of firm survival as well as failure process (see Figure IV.1, Figure IV.2). The study employs the Kaplan and Meier estimates (1958) which are non-parametric estimates of firm survivor function or the probability of survival until time t. In various empirical studies, the Kaplan-Meier analysis is considered a good way to observe the basic shape of the survival data[71].

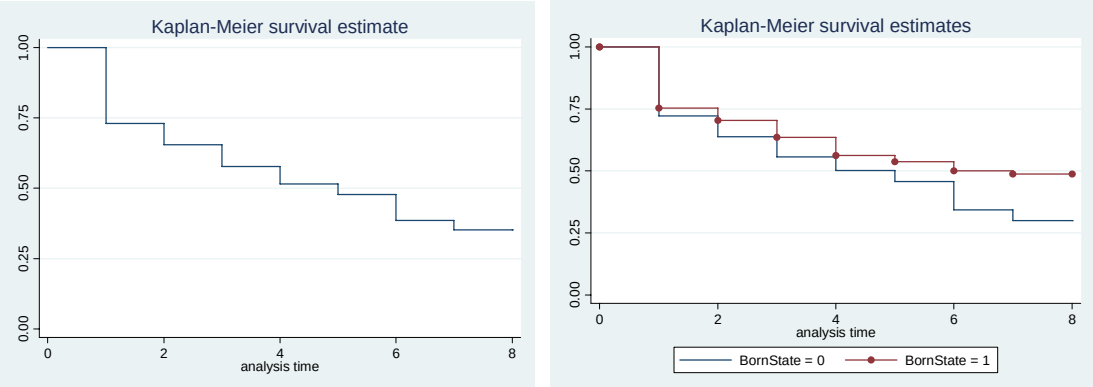

Figure IV.1: Kaplan–Meier Estimates of Survival Function

In Figure IV.1, the left graph shows that, the survival of SOEs and private firms in Vietnam decreases immediately from the first year. This process is strongest in the first year leaving the survival probability around 75% and decreases afterwards. This fact is

[71] http://psweb.sbs.ohio-state.edu/faculty/jbox/Courses/ps786eh/statanotes.pdf.

similar to the thesis of a 'liability of adolescence' which argues that the hazard rate of failure increases instantly at the beginning, attains the highest after around one or two years, then has a monotonic decline (Strotmann, 2008). This argument is underlined by Wagner (1994) and Honjo (2000). This thesis is explained by the fact that new firms face tough challenges during market penetration, the most sensitive period of getting insolvent from building up the initial resources (Strotmann, 2008). Besides, the right graph provides comparison of survival probabilities between SOEs and private enterprises. Obviously, SOEs have higher opportunity to survive than private ones. After foundation year, both have significantly low probabilities of survival, around 75%, then face lighter risks of failure until the end of the analysis period.

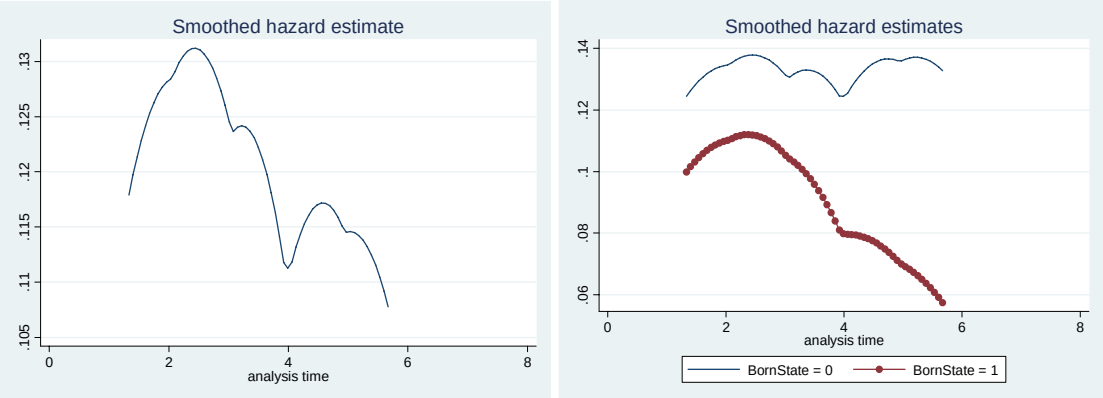

Figure IV.2: Non-parametric Hazard Functions

In Figure IV.2, more clearly, the smoothed hazard rate illustrates the evolution of the risk of firm failure. As aforementioned, hazard rate is defined as the probability of firm failure in the period t given that firm survives until period t. The left graph in the Figure IV.2 expresses that new firms face high risk of death at the beginning of life. This risk increases with age, extremely after two years, then decreases strongly until firms are around four years. Besides, the right graph in Figure IV.2 describes the comparison of hazard rates of firm failure between state-owned and private enterprises. Clearly, the mortality risk of private firms is higher than that of stated-owned ones. Both of them face high failure risk at the first year; reach the highest one at around the third years. The hazard of death of the SOEs releases dramatically afterwards, but that of private firms increases again after the forth year.

Why do new stated-owned and private enterprises firms in the manufacturing sector in Vietnam have such patterns of survival?. The next section will explain by empirical results.

5. Empirical results and discussion

This section analyses the results of simple and multiple regressions for the new stated-owned and private enterprises in the manufacturing sector in Vietnam for the whole sample and for each sector to compare with each other. In general, the output is presented stepwise for ownerships, firm attributes, industrial factors, and macroeconomic factors to facilitate comparisons with each other.

Our dataset is discrete time or annual data, thus this study applies CPH model with Efron's (1977) approximation option to handle the aforementioned 'ties' failures, similar to most other empirical studies (Carreira and Teixeira, 2009). To test the proportional hazard assumption, the essay uses the Schoenfeld test[72] for each individual factor and for the full set of covariates. All the results of these tests for full set of factors accept the hypothesis of proportionality, thus the basic specification as a proportional hazard model is suitable. The Wald test rejects the null hypothesis that all parameters are zero at the 0.01 level of significance. The hypothesis of no unobserved heterogeneity was tested, applying the shared frailty option, and not rejected. Therefore, the control for unobserved heterogeneity will avoid biased estimates of the explanatory variables as well as the duration dependence coefficients (Esteve-Pe´rez, S. and Man˜ez-Castillejo, 2008).

We report coefficients of independent variables instead of coefficients of hazard ratios in regression results. In our survival model, the dependent variable is the hazard rate, thus a negative (positive) coefficient means that the corresponding factor decreases (increases) the instantaneous risk of firm failure, thus increasing (decreasing) the probability of firm survival.

5.1. Determinants of new firm survival for the whole sample

This section focuses on the empirical results of determinants of new firm survival for the whole sample (see Table IV.5). The estimates are displayed by inserting stepwise

[72] According to Castilla (2007), to check the proportional hazard rates assumption, the most commonly employed technique is the analysis of residuals or Schoenfeld residuals. The residuals are stored after estimating an survival model. The saved residuals are used to be fit with a smooth function of time to test a null hypothesis of relationship between the residuals and time or null hypothesis of proportional hazards. This hypothesis is rejected, if the slope of the curve is equal 0 (Castilla, 2007, pp. 218).

more groups of variables to evaluate the change of factor effect in various economic contexts. The output is presented stepwise for ownerships, firm attributes, industrial factors, and macroeconomic factors to facilitate comparisons with each other. The study especially investigates effects of firm size and start-up size on firm failure to test for 'liability of adolescence'. Models (1) and (2) present effects of ownerships on hazard rate of firm failure. The third and forth models investigate effects of firm's attributes on firm failure. Controlling industrial and macroeconomic factors, model (5) evaluates how the effects of above factors change. Models (6), (7), (8) investigate how these effects change under effects of start-up factors at firm level. Inserting dummies of size cohorts, the final model investigates the effects of comprehensive specification of factors on firm failure.

In Table IV.5, generally, there are considerable interactions among factors, which support the *hypothesis 6*[73]. In other words, when inserting more factors, the effects of factors change in terms of magnitudes, and even signs. There are two sign-switched factors, *State* and *Leverage*. The estimates highlight the stark change of the effect of state ownership on hazard rate. In the first two models, the effect of *State* on firm failure is significant and negative. However, under the effects of firm attributes (see model 3), it turns to be insignificant. This insignificant effect is even weaker Afterwards (in models 4, 5, 6). This suggests that the negative effect of state ownership fades under other effects or the economic contexts. Subsequently, it unexpectedly turns to be significant and positive when inserting start-up total assets in the model. This implies that after controlling the effect of start-up total assets, private-ownership seems to benefit firm survival. This significant and positive effect remains after controlling other factors concerning firm size, in models 7, 8, and 9, with a comprehensive specification of economic contexts. Thus, after controlling the effect of firm size, the first *hypothesis*[74] seems unsupported. It may be explained that the stark difference of hazard rates of firm failure between SOEs and private enterprises results from their disparity of firm sizes, especially start-up sizes. Besides, joint-stock ownership, representing the effect of equitization, increases notably probability of survival with significant and negative coefficients.

[73] *There are interaction effects among internal and external factors on firm survival.*
[74] *State-owned enterprises have higher probability of firm survival.*

With respect to firm attributes, the most important determinant of firm survival seems to be the labour productivity, representing firm sustainability, which has the strongest negative and significant effects, from -0.158 to -0.222. This implies that a firm with an advantage of higher productivity will find it easier to survive. Besides, this supports *the second hypothesis*[75], furthermore, expresses the power of market selection. The magnitude of this effect is affected by industrial and macroeconomic effects, that is, it increases in models 5 and 6. However, it slightly decreases after controlling start-up factors, in models 7, 8; then switches to increase after controlling firm size at different cohorts, in the final model. In contrast to labour productivity, *Sale-asset ratio*, with positive and significant coefficients around of 0.023, is a harmful factor for firm survival. It suggests that, for the case of new firm, higher return in terms of total assets seems to be riskier for firm survival. As aforementioned, high value of sales may require higher corresponding resources of input and loans that make firm more sensitive to insolvency. While the effects of ROC and ROE are insignificant, the effect of *Profit per employee is significant and negative,* implying that firms more profitable will survive longer. This seems to express the power of market selection. In addition, it may suggest for new SOEs and private firms in Vietnam that to reduce the failure risk, they should pay attention to increase profit unit rather than total return per total assets. Therefore, *the third hypothesis*[76] is only only suitable for the case of profit per employee.

Regarding external factors at industry level, high market share, measured by the share of firm total sales per industry total sales, threatens the firm with high risk of failure. Similar to the aforementioned analysis of sale-asset ratio, higher total sales of a firm normally require a high value of corresponding input which may lead to a high risk of insolvency. Similarly, market size which is measured by the number of firms in each industry increases the risk of firm failure. This is opposite to findings of Strotmann (2008). He interprets the negative effect of market size on failure risk due to the fact that "in broader markets a start-up of a new firm is less perceptible for the incumbents"[77]. This explanation seems inappropriate for a small market like Vietnam. The more firms in the market, the higher competition pressure, and the higher risk of exit. In contradiction, the variable of total employees in the industry seems to extend

[75] *Firm survival depends positively on sustainability.*
[76] *Firm survival depends positively on profitability*
[77] Strotmann, (2008, pp.95)

firm life. It suggests that an industry which attracts labour source is a favorable and potential market for new firms. Consequently, the *hypothesis 7*[78] is only supported in the case of market size measured by total employees in industry.

With respect to external factors at national level, GDP reduces remarkably the hazard rate of firm failure. This may imply that the economic development in terms of GDP expresses a favorable environment for firm entry and survival. With regard to geographical factor, location in the North supports firms to survive. This seems suitable because the capital of Vietnam is in the North, Hanoi, which is the center of the national economy as well as the culture. This part of country has advantages of transportation, communication, infrastructure, and high living standard. Therefore, the *hypothesis 8*[79] is appropriate.

In terms of start-up factors, as aforementioned, they highlight their interactions to ownership effect on firm failure. If the start-up leverage only releases negative and insignificant effects of state-ownership on firm mortality, the firm start-up total assets switch these effects to positive and significant effects. These effects are accelerated Afterwards, in models 8, 9. Remarkably, firms with higher start-up total assets have higher survival prospects. High start-up total assets seem to create sound capacity for firms to better confront with the risk of insolvency. With respect to start-up total sales, once again, the estimates confirm that a firm with higher total sales faces higher risk of firm failure. These results support *hypothesis 5*[80].

With respect to size cohorts based on total number of employees, these factors support the aforementioned prediction that small firms have to tackle over high risk of death, which is mentioned in the *hypothesis 4*[81]. This is explained that smaller firms are supposed to face more severe restrictions on capital markets, resulting in a more severe threat of bankruptcy (Strotmann, 2008). They are disadvantages of small firms in competition for increasing profitability and productivity to reach higher survival prospects. Consequently, the higher number of employees, the lower hazard rate of firm mortality.

In short, the survival probability of SOEs is higher than that of private ones, but under other economic effects, especially after controlling the start-up total assets, state-

[78] *Hazard rate of new firm failure depends negatively on competitiveness and concentration of industry*
[79] *Unfavorable current macroeconomic conditions increase the hazard rate of failure*
[80] *Hazard rate of closure depends on start-up firm factors.*
[81] *Hazard rate of failure decreases with increased firm size.*

ownership does not indeed benefit the length of firm life. As aforementioned in the section of data statistics of the whole sample, in Table IV.4, there are stark differences of the ranges of start-up total assets between SOEs and private enterprises. This means that there are samples of data with ranges of start-up total assets including only one kind of ownership. Following Mata and Portugal (2002), for a robustness check, in the next section, this study runs the same regressions for a sample at the same cohort of size in terms of start-up total assets where there are both SOEs and private enterprises, which reduces our sample down to 1,845 observations of 338 new SOEs and 66 new private firms.

Table IV.5: Determinants of New-firm Failure for the Whole Sample

Dependent variable: Hazard rate		**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
Groups of independent variables										
Ownership	State	-0.4222***	-0.3265***	-0.1305	-0.1129	-0.0830	-0.0650	0.6207***	0.6125***	0.9676***
		(0.126)	(0.126)	(0.160)	(0.161)	(0.169)	(0.179)	(0.227)	(0.227)	(0.248)
	Joint-Stock		-2.2396**	-2.2208**	-2.2137**	-2.2869**	-2.2898**	-2.4772**	-2.4925**	-2.5124**
			(1.006)	(1.007)	(1.022)	(1.023)	(1.024)	(1.024)	(1.025)	(1.024)
Sustainability	Labour productivity			-0.1576***	-0.1553***	-0.1877***	-0.1877***	-0.1047**	-0.1291**	-0.2217***
				(0.043)	(0.044)	(0.045)	(0.045)	(0.049)	(0.057)	(0.062)
	Leverage			-0.1937	-0.2408	-0.1083	-0.0425	0.0031	0.0186	0.0978
				(0.202)	(0.206)	(0.208)	(0.299)	(0.293)	(0.293)	(0.291)
Profitability	Sale-Asset ratio			0.0244***	0.0255***	0.0276***	0.0276***	0.0184*	0.0179*	0.0234**
				(0.009)	(0.009)	(0.009)	(0.009)	(0.010)	(0.011)	(0.010)
	ROC				-0.4138	-0.4315	-0.4340	-0.2495	-0.1898	-0.2266
					(0.514)	(0.523)	(0.523)	(0.578)	(0.589)	(0.572)
	ROE				0.0072	0.0059	0.0059	0.0049	0.0047	0.0051
					(0.022)	(0.022)	(0.022)	(0.023)	(0.023)	(0.023)
	Profit per employee				-0.0032***	-0.0033***	-0.0033***	-0.0038***	-0.0038***	-0.0042***
					(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Industrial factors	Market share					1.6597	1.6589	2.8915*	2.8892*	3.1381**
						(1.692)	(1.690)	(1.555)	(1.559)	(1.524)
	Market size*					-0.5728***	-0.5716***	-0.4808***	-0.4854***	-0.5463***
						(0.169)	(0.170)	(0.170)	(0.171)	(0.172)
	Market size**					0.7741*	0.7800*	0.8323**	0.8397**	0.6954*
						(0.403)	(0.400)	(0.399)	(0.403)	(0.399)
National factors	GDP					-15.4525	-15.5228***	-15.3097***	-15.4466***	-15.0316*
						(13.600)	(5.756)	(5.363)	(5.426)	(7.818)
	North					-0.4122**	-0.4105**	-0.5304***	-0.5312***	-0.4797***
						(0.181)	(0.181)	(0.184)	(0.184)	(0.184)
Start-up factors	Start-up Leverage						-0.1060	0.3221	0.2896	0.4223
							(0.349)	(0.356)	(0.358)	(0.361)
	Start-up total Assets							-0.2806***	-0.3152***	-0.2324***
								(0.057)	(0.071)	(0.074)
	Start-up total Sales								0.0425	0.0954*
									(0.052)	(0.053)

Firm size	Small size									1.1613***
										(0.334)
	Medium size									0.3506
										(0.260)
	Large size									-0.0438
										(0.319)
	Log-likelihood	-2041.32	-2035.57	-2027.96	-2025.28	-2015.77	-2015.72	-2003.05	-2002.71	-1994.56
	χ^2 (Wald test)	12.05	23.54	38.76	44.12	63.15	63.24	88.58	89.26	105.55
	P value (Wald test)	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
	χ^2 (Schoenfeld test)	8.78	8.77	14.13	15.78	21.88	22.06	22.64	24.62	30.77
	N. of firms	544.00	544.00	544.00	544.00	544.00	544.00	544.00	544.00	544.00
	N. of events	349.00	349.00	349.00	349.00	349.00	349.00	349.00	349.00	349.00
	N. of observations	2530	2530	2530	2530	2530	2530	2530	2530	2530

Notes: *: total number of employees in 3-digit industry; **: total number of firms in 3-digit industry. Efron method is applied for ties. Because Schoenfeld test was significant, the proportional hazard assumption was not rejected. Wald test rejects the null that all parameters are zero. Standard errors are in parentheses. An asterisk (*), (**), (***) denote statistical significance at least at the 10%, 5%, 1% levels, respectively.

5.2. Determinants of new firm survival at the same cohort of size

This section focuses on the robustness check. Thus, this study runs the same regressions for a sample at the same cohort of size in terms of start-up total assets where there are both SOEs and private enterprises (see Table IV.6). Similar to the previous section, the estimates are displayed stepwise by inserting groups of variables to evaluate the change of factor effect in various economic contexts. The output is presented stepwise for factors of ownership, firm attributes, industrial factors, and macroeconomic factor to facilitate comparisons with each other. Models (1), (2) present effects of ownership on hazard rate of firm failure. The third and forth models investigate how factor effects change under main firm's attributes. Controlling industrial and macroeconomic factors, model (5) evaluates how the effects of above determinants change. Models (6), (7), (8) investigate how these effects change under the effects of start-up factors at firm level. Adding dummies of size cohort, the final model investigates the effects of comprehensive specification of factors on firm failure.

In Table IV.6, in the context of the same cohort of firm size in terms of start-up total assets, state-ownership is generally unbeneficial to firm survival. The first evidence of the effect of firm size is that the context of the same cohort of firm size makes the effect of state-ownership no longer significant. The insignificant effects of state-ownership on firm failure are negative in the first two models; turn to positive ones under internal and external factors in four next models. Especially after controlling the effect of start-up total assets, similar to the estimates in the previous section, these effects switch to significant and positive ones. In other words, these results support the robustness of previous estimates. They imply that after controlling firm size, private ownership, not state-ownership, increases firm survival.

Regarding to other factors, in general, the results in this case are similar to those in the previous section in terms of magnitude and sign of effects. There are only two factors turning to insignificant in the final model, namely GDP and Northern location. In comparison with results in the previous section, effects of state-ownership and total assets in this section are slightly stronger.

Furthermore, the comparison of determinants of each kind of ownerships, state and private ownerships, is displayed in the next sections.

Table IV.6: Determinants of New-firm Failure for the Same Cohort of Firm Size

Dependent variable: Hazard rate		**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
Groups of independent variables										
Ownership	State ownership	-0.2525	-0.1488	0.0494	0.0752	0.1190	0.1370	0.7274***	0.7090***	0.9978***
		(0.177)	(0.179)	(0.206)	(0.208)	(0.222)	(0.228)	(0.270)	(0.269)	(0.280)
	Joint-Stock		-1.6197	-1.5272	-1.5071	-1.6013	-1.6001	-1.8896*	-1.8979*	-1.9233*
			(1.014)	(1.015)	(1.015)	(1.021)	(1.021)	(1.024)	(1.024)	(1.024)
Sustainability	Labour productivity			-0.1387***	-0.1335***	-0.1583***	-0.1587***	-0.0962*	-0.1364**	-0.2436***
				(0.049)	(0.051)	(0.052)	(0.051)	(0.055)	(0.064)	(0.070)
	Leverage			-0.4371*	-0.5406**	-0.4102	-0.3234	-0.2422	-0.2123	-0.1113
				(0.245)	(0.252)	(0.257)	(0.356)	(0.352)	(0.354)	(0.351)
Profitability	Sale-Asset ratio			0.0236**	0.0239**	0.0252**	0.0252**	0.0187*	0.0179	0.0241**
				(0.009)	(0.010)	(0.010)	(0.010)	(0.010)	(0.011)	(0.011)
	ROC				-0.6694	-0.7036	-0.7085	-0.4400	-0.3226	-0.4343
					(0.616)	(0.617)	(0.616)	(0.659)	(0.672)	(0.659)
	ROE				0.0340	0.0295	0.0298	0.0262	0.0269	0.0261
					(0.048)	(0.049)	(0.049)	(0.050)	(0.050)	(0.047)
	Profit per employee				-0.0031**	-0.0032***	-0.0031***	-0.0040***	-0.0039***	-0.0043***
					(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Industrial factors	Market share					2.6403	2.6481	2.8937	2.9231	3.3024
						(2.563)	(2.551)	(2.500)	(2.506)	(2.341)
	Market size*					-0.4645**	-0.4613**	-0.4226**	-0.4260**	-0.4944**
						(0.196)	(0.195)	(0.197)	(0.196)	(0.199)
	Market size**					0.7989*	0.7994*	0.7693*	0.7677*	0.6190
						(0.448)	(0.446)	(0.448)	(0.444)	(0.431)
National factors	GDP					-15.4057**	-15.5170***	-15.4671	-15.5661**	-16.1862***
						(6.389)	(3.216)	(10.948)	(6.306)	(2.433)
	North					-0.3122	-0.3076	-0.3909*	-0.3948*	-0.3089
						(0.216)	(0.217)	(0.218)	(0.218)	(0.216)
Start-up factors	Start-up Leverage						-0.1414	0.2598	0.1969	0.3600
							(0.406)	(0.416)	(0.421)	(0.423)
	Start-up total Assets							-0.3640***	-0.4194***	-0.2983***
								(0.086)	(0.098)	(0.103)
	Start-up total Sales								0.0678	0.1249**

									(0.057)	(0.058)
Firm size	Small size									1.2003***
										(0.450)
	Medium size									0.3434
										(0.410)
	Large size									-0.4777
										(0.613)
	Log-likelihood	-1486.16	-1483.93	-1477.59	-1473.41	-1467.59	-1467.53	-1457.99	-1457.29	-1449.03
	χ^2 (Wald test)	2.16	6.60	19.29	27.65	39.29	39.42	58.48	59.89	76.41
	P value (Wald test)	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
	χ^2 (Schoenfeld test)	3.76	4.15	7.65	10.26	13.08	13.53	13.89	16.09	15.38
	N. of firms	404.00	404.00	404.00	404.00	404.00	404.00	404.00	404.00	404.00
	N. of events	268.00	268.00	268.00	268.00	268.00	268.00	268.00	268.00	268.00
	N. of observations	1845	1845	1845	1845	1845	1845	1845	1845	1845

Notes: *: total number of employees in 3-digit industry; **: total number of firms in 3-digit industry. Efron method is applied for ties. Because Schoenfeld test was significant, the proportional hazard assumption was not rejected. Wald test rejects the null that all parameters are zero. Standard errors are in parentheses. An asterisk (*), (**), (***) denote statistical significance at least at the 10%, 5%, 1% levels, respectively.

5.3. Comparative analysis for different ownerships

This section focuses on determinants of new firm survival in each type of ownerships (see Table IV.7). The purpose of this study is to investigate which are main determinants for each kind of ownerships, including estimates for state-ownership in models (1)-(4), for private-ownership in models (5)-(8); and to compare between each other. The estimates are displayed stepwise by adding more effects at industrial and national levels to evaluate the change of factor effect in various economic contexts and facilitate comparisons.

In Table IV.7, generally, there are distinctions between new SOEs and private firms in terms of determinants of failure risk. With respect to firm's attributes, there are only two factors have same effects in decreasing failure hazard for both ownerships, namely labour productivity and profit per employee. Thus, *hypotheses 2, 3* are suitable for these cases. However, these effects are stronger for state ownership. Similar to the case of the whole sample, *leverage* effect is insignificant for both ownerships. In contrast to the case of the whole sample, effects of sale-asset ratio are only significant and positive for private enterprises. While ROC turns to significantly decrease hazard rate of firm failure for SOEs, it is insignificant for the private ownership. It implies that at sufficiently large size, such as that of SOEs, ROC indeed represents efficiency of firm. In principle, high value of return requires high value of corresponding resources of input and loans, but sufficiently large size makes firms strong enough to deal with those and become no longer sensitive to insolvency. Similarly, ROE has a positive and significant effect on new firm failure only for private enterprises.

Regarding to external factors, higher market share really threatens firm survival of both ownerships, dramatically for private firms under the context of full factors. However, market size in terms of total employees in each industry seems to prolong significantly life of private firms. It suggests that industries that have increasing number of employees open favourable opportunities for new private firms. Therefore, the *hypothesis 7*[82] is only supported in case of industry total employees for private ownership. While GDP only supports significantly development of private firms, the northern location provides advantages to SOEs survival. It suggests that SOEs may

[82] *Hazard rate of new firm failure depends negatively on competitiveness and concentration of industry*

have priority to choose more favourable location than private enterprises. Therefore, these findings support the *hypothesis 8*[83] differently for two ownerships.

In terms of start-up factors, effects of firm size, negative for total assets and positive for total sales, are significant for only private firms. The reasons may be explained that those sizes of private firms are still too small compared with the threshold of economies of scale, thus a small difference in firm size will affect considerably on firm survival. Besides, small SOEs face high risk of failure. Therefore, generally, *hypotheses 4, 5* are suitable for these cases. Similarly to estimates in the previous sections, equitization in terms of joint-stock ownership has significant and negative effect on the risk of firm mortality.

[83] *Unfavorable current macroeconomic conditions increase the hazard rate of failure*

Table IV.7: Determinants of New-firm Failure for Different Ownerships

Dependent variable: Hazard rate		**SOEs**				**Private enterprises**			
Groups of independent variables		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sustainability	Labour productivity	-0.2871***	-0.3717***	-0.3727***	-0.3077*	-0.0986**	-0.1263**	-0.1262**	-0.1693**
		(0.101)	(0.107)	(0.105)	(0.160)	(0.050)	(0.050)	(0.050)	(0.069)
	Leverage	-0.3141	-0.2587	-0.4358	-0.5163	-0.5557**	-0.4706	-0.3932	-0.1297
		(0.320)	(0.330)	(0.623)	(0.610)	(0.281)	(0.291)	(0.369)	(0.371)
Profitability	Sale-Asset ratio	0.0312	0.0447	0.0454	0.0436	0.0180*	0.0194*	0.0194*	0.0146*
		(0.077)	(0.081)	(0.081)	(0.098)	(0.010)	(0.010)	(0.010)	(0.011)
	ROC	-1.3271**	-1.3938**	-1.3970**	-1.3321**	-0.2284	-0.2703	-0.2824	0.1196
		(0.597)	(0.616)	(0.613)	(0.620)	(0.698)	(0.699)	(0.699)	(0.766)
	ROE	-0.0010	-0.0002	-0.0003	-0.0013	0.3345**	0.3263**	0.3239**	0.3799**
		(0.036)	(0.034)	(0.034)	(0.036)	(0.147)	(0.150)	(0.149)	(0.162)
	Profit per employee	-0.0161**	-0.0164**	-0.0165**	-0.0138**	-0.0030**	-0.0031**	-0.0031**	-0.0044***
		(0.006)	(0.007)	(0.007)	(0.007)	(0.001)	(0.001)	(0.001)	(0.001)
Industrial factors	Market share		2.8421*	2.8512*	3.4956**		11.3452	11.5717	26.7285***
			(1.696)	(1.659)	(1.586)		(7.664)	(7.658)	(7.670)
	Market size*		-0.4557	-0.4415	-0.3349		-0.7294***	-0.7224***	-0.7215***
			(0.365)	(0.369)	(0.380)		(0.204)	(0.207)	(0.202)
	Market size**		1.0295	0.9890	0.8077		0.2401	0.2468	0.1597
			(1.340)	(0.868)	(0.900)		(0.543)	(0.475)	(0.478)
National factors	GDP		-15.7592	-12.8562	-14.9140		-16.2297	-16.6413***	-16.6345***
			(19.947)	(34.466)	(9.985)		(16.832)	(4.470)	(5.247)
	North		-0.4890**	-0.4922**	-0.5894**		-0.3969	-0.3926	-0.4099
			(0.244)	(0.244)	(0.264)		(0.279)	(0.278)	(0.279)
Start-up factors	Start-up Leverage			0.2683	0.9551			-0.1352	0.3574
				(0.786)	(0.801)			(0.400)	(0.419)
	Start-up total Assets				-0.0675				-0.3067***
					(0.195)				(0.088)
	Start-up total Sales				-0.0568				0.1112*
					(0.188)				(0.057)
Firm size	Small size				1.0886*				1.0751
					(0.571)				(0.655)
	Medium size				0.3530				0.1575
					(0.375)				(0.681)

	Large size				-0.0591				0.0888
					(0.372)				(0.919)
Ownership	Joint-Stock	-1.9227*	-2.0302**	-2.0262**	-2.1977**				
		(1.014)	(1.016)	(1.016)	(1.022)				
	Log-likelihood	-380.49	-376.11	-376.05	-370.22	-1443.62	-1436.28	-1436.22	-1419.45
	χ^2 (Wald test)	31.05	39.81	39.92	51.58	16.17	30.86	30.98	64.51
	P value (Wald test)	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
	χ^2 (Schoenfeld test)	6.77	10.29	11.02	18.25	7.71	9.71	10.44	17.69
	N. of firms	162	162	162	162	382	382	382	382
	N. of events	83	83	83	83	266	266	266	266
	N. of observations	836	836	836	836	1694	1694	1694	1694

Notes: *: total number of employees in 3-digit industry; **: total number of firms in 3-digit industry. Efron method is applied for ties. Because Schoenfeld test was significant, the proportional hazard assumption was not rejected. Wald test rejects the null that all parameters are zero. Standard errors are in parentheses. An asterisk (*), (**), (***) denote statistical significance at least at the 10%, 5%, 1% levels, respectively.

6. Conclusions

This essay focuses on determinants of survival of new SOEs and private firms in the manufacturing sector in a transition economy, Vietnam, during the period 2000-2007. Both internal and external factors, time-invariant and time-varying covariates are investigated in this essay. The findings of this study make some significant contributions to the literature on new firm survival and suggest some important policy implications.

Generally, for the case of new manufacturing SOEs and private firms in Vietnam, there is evidence supporting the thesis of a 'liability of adolescence' which proposes that the hazard rate of failure increases instantly at the beginning, attains the highest within one or two years, then keep a monotonic decline[84]. Besides, the highest hazard rate reaches the highest within the second and third years. This suggests that, to pave the way for these firms to develop, policy makers should provide them some supports, such as tax exemption, low-cost loans, low-rent land, and the like, at the first years.

Besides, findings indicate that the negative effect of state-ownership fades under other effects or the economic contexts. After controlling the effect of start-up total assets, private-ownership seems to benefit firm survival. It could be interpreted that the stark difference in terms of hazard rate of failure likely results from the disparity of the start-up total assets between SOEs and private firms.

In terms of internal effects, the most important factor is labour productivity. There is evidence of market selection that high labour productivity is the most important internal factor supporting firm survival. This evidence supports the industrial organization predictions that the market selection is based on efficiency measures to drive low-productivity firms out of the market (Carreira and Teixeira, 2009). Other evidence of power of market selection is that survivals of both ownerships depend on firm profitability in terms of profit per employee. Therefore, the implication for managers of these new firms is that they should increase labour productivity as well as profit per employee, both performance factors relative to employees, by improvement of labour skill.

[84] Strotmann (2008)

Regarding external factors, market share is considered an obstacle for SOE survival. In contrast, findings imply that industries that have increasing number of employees open favourable opportunities for new private firms. While GDP only supports significantly development of private firms, the northern location provides advantages to SOE survival. In terms of start-up factors, while total assets increase probability of firm survival, total sales decrease that for the case of private firms. Besides, small SOEs face high risk of failure while equitization decreases the risk of firm mortality.

There are some limitations of this study. Due to the limitation of the data, the study is able to measure only labour productivity, which only investigates one of three main factors of production; labour, while total factor productivity (TFP) covers all these factors. In addition, this essay could not examine the effect of personnel, talent management, innovation, and export orientation that are also very important potential determinants of new firm survival. Besides, further investigation of contextual moderating factors relative to external factors should be considered.

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APPENDIX

Abstract

This dissertation concentrates on the dynamics of firm growth, productivity and survival in a developing country, Vietnam, and investigates their main determinants under the context of globalization during the period 2000-2007. *The first essay* tests the validity of Gibrat's law and investigates determinants of firm growth of the commercial-service sector by employing the dynamic panel model. Applying the system GMM estimator to control unobserved heterogeneity and endogeneity, the findings imply that Gibrat's Law should be rejected. The results confirm the sensitivity of the growth-size relationship to firm attributes. Besides, firm size and labor quality are main determinants of firm growth. *The second essay* empirically investigates the impact of IT facilities and development investments on labor productivity to test the "productivity paradox" and evaluates interaction effects of firm-level contextual factors on this impact. In contrast to most of the existing that mainly consider patents or R&D in the relationship with firm productivity[86], the essay investigates actual investments in two main areas: (i) Information technology facilities; (ii) development investments. The essay applies the fixed and random effects models for the manufacturing and commercial-service sectors, and the whole economy. Findings imply that the "productivity paradox" does not occur for factor of R&D rate in investments of all firms, for computerization for manufacturing firms, for LAN connection and Internet situation for the commercial-service firms. And these effects significantly depend on contextual moderating factors. *The third essay* focuses on determinants of survival of new state-owned and private firms in the manufacturing sector. Employing the semi-parametric Cox proportional hazard model, the essay provides evidence which supports the thesis of a 'liability of adolescence'. Besides, the essay finds that the negative effect of state-ownership fades under other effects or economic contexts. After controlling the effect of start-up total assets, private-ownership seems to benefit firm survival. In addition, there is evidence of market selection that labour productivity and profit per employee are the most important internal factor in improving firm survival. There are differences between state-owned and private firms in terms of determinants of survival. Market share and small size are considered an obstacle only for SOEs firm survival. However, equitization reduces the risk of SOEs mortality. For private firms, in terms of

[86] Ghosa and Nair-Reichert, 2008

start-up factors, although total assets increase probability of survival, total sales decrease. Besides, industry which has increasing number of employees opens favourable opportunities only for new private firms. While the macroeconomic factor, GDP, significantly supports the development of private firms, the northern location is an advantage to the survival of SOEs.

Zusammenfassung

Diese Dissertation konzentriert sich auf die Dynamik des Wachstums von Unternehmen, deren Produktivität und Überlebenswahrscheinlichkeit in Vietnam. Die Arbeit untersucht die wichtigsten Determinanten dieser drei Merkmale auf Unternehmensebene über die Periode 2000-2007. Der erste Aufsatz überprüft die Gültigkeit des sog. Gibrat Gesetzes und untersucht die Determinanten des Unternehmenswachstums im Handels-und Dienstleistungssektor anhand eines dynamischen Panel-Data Ansatzes. Der GMM Schätzer, den ich verwende, kontrolliert für die potenziellen Endogenitätsprobleme und für die unbeobachtbare Heterogenität innerhalb meiner Stichprobe. Durch das Heranziehen dieses Schätzers komme ich zum Ergebnis, dass das sog. Gesetz von Gibrat abgelehnt werden soll. Die Ergebnisse zeigen, daß Unternehmensgröße und Produktivität des Faktors Arbeit die wichtigsten Determinanten des Unternehmenswachstums sind.

Der zweite Aufsatz untersucht empirisch die Auswirkungen von IT-Einrichtungen und Investitionen auf die Arbeitsproduktivität. Im Gegensatz zu den meisten Arbeiten in der vorhandenen Literatur, die sich auf die Beziehung der F&E Ausgaben/ Patente und Produktivität konzentrieren, untersuche ich die tatsächlichen Investitionen in zwei Hauptbereichen: (i) IT-Einrichtungen, (ii) die Entwicklung des Investitionskapital. Die ökonometrische Methode berücksichtigt das Vorliegen von sog. fixed und random Effects und impliziert, daß das sog. "Produktivität Paradoxon" für die F & E-Quote nicht vorliegt.

Der dritte Aufsatz konzentriert sich auf die Determinanten der Überlebenswahrscheinlichkeit von staatlichen und privaten Unternehmen in der verarbeitenden Industrie. Im Rahmen dieses Aufsatzes wird das semi-parametrische Cox Proportional Hazard Model verwendet. Die Ergebnisse zeigen, daß die Überlebenswahrscheinlichkeit der neuen staatlichen und privaten Unternehmen unterschiedliche Determinanten aufweisen.

Curriculum Vitae

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Curriculum Vitae

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Education and training

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Other language(s)

Self-assessment

European level (*)

English

Understanding				**Speaking**				**Writing**	
Listening		Reading		Spoken interaction		Spoken production			
C1	Proficient user	C1	Proficient user	B2	Independent user	B2	Independent user	C1	Proficient user

(*) Common European Framework of Reference (CEF) level

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3. Holland scholarship for Master's program in Development Economics - The Hague Government (2001-2004).
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Research/projects

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4. Development quality in Vietnam – Initial Evaluation. Research funded by Friedrich – Ebert Institute in 2005. Research member.

Personal interests

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Annexes Copies of degree, certificate available upon request.